

# ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

Edited by  
**LEWIS STEPHEN PILCHER, M.D., LL.D.**  
of New York

With the Collaboration of  
**SIR WILLIAM MACEWEN, M.D., LL.D.**      **SIR W. WATSON CHEYNE, C.B., F.R.S.**  
of Glasgow      of London

EXOPHTHALMIC GOITRE	385
ALBERT J. OCHSNER, M.D.,	CHICAGO
THE SURGICAL TREATMENT OF GOITRE	395
MILES F. PORTER, M.D.,	FT. WAYNE
RESULTS OF OPERATIVE TREATMENT OF EXOPHTHALMIC GOITRE	400
VERNON C. DAVID, M.D.,	CHICAGO
THE SURGICAL TREATMENT OF PERFORATED ULCER OF THE STOMACH	403
ABRAHAM O. WILENSKY, M.D.,	NEW YORK
A REPORT OF NINE CONSECUTIVE OPERATIONS FOR PERFORATED GASTRIC AND DUODENAL ULCERS	410
JOHN F. SHEA, M.D.,	BRIDGEPORT
RUPTURE OF THE COMMON BILE-DUCT ASSOCIATED WITH SUB-PHRENIC ABSCESS	414
HERMON C. BUMPUS, JR., M.D.,	ROCHESTER
ANOMALIES OF THE GALL-BLADDER AND BILE-PASSAGES	419
AUGUST SCHACHNER, M.D.,	LOUISVILLE
THE INTERPRETATION OF FUNCTIONAL RENAL TESTS WITH SPECIAL REFERENCE TO THE SIGNIFICANCE OF MINIMAL EXCRETION OF PHTHALEIN AND INDIGOCARMIN	434
EDWIN BEER, M.D.,	NEW YORK
TRAUMATIC INJURIES OF THE KIDNEY AND URETER	459
HENRY G. BUGBEE, M.D.,	NEW YORK
OS. CALCIS FRACTURE	480
FREDERIC J. COTTON, M.D.,	BOSTON
TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY	487
STATED MEETING, HELD MAY 8, 1916.	
TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY	495
STATED MEETING, HELD APRIL 12, 1916.	
STATED MEETING, HELD APRIL 27, 1916.	

**J. B. LIPPINCOTT COMPANY, PUBLISHERS**  
MONTREAL      PHILADELPHIA      LONDON

Entered at the Post-Office at Philadelphia and admitted for transmission through the mails at second-class rates.  
Price \$5.00 a year. Copyright, 1916, by J. B. LIPPINCOTT COMPANY, 227-231 South Sixth Street.



# Stanolind Liquid Paraffin

Trade-Mark Reg. U. S. Pat. Off.

(Medium Heavy)

***Tasteless—Odorless—Colorless***

is practically without chemical affinity, and is affected by very few chemical re-agents. This feature is of paramount importance where physicians desire to administer a mineral oil in connection with other agents.

A trial quantity with informative booklet will be sent on request.

**Standard Oil Company**

(Indiana)

72 W. Adams St., Chicago, U. S. A.

# ANNALS *of* SURGERY

VOL. LXIV

OCTOBER, 1916

No. 4

## EXOPHTHALMIC GOITRE \*

IMPORTANT FEATURES FROM THE STAND-POINT OF THE CLINICAL SURGEON

BY ALBERT J. OCHSNER, M.D.  
OF CHICAGO

IN order to establish a reasonable basis for employing surgical treatment for the relief of exophthalmic goitre it seems proper to give some attention to the histological findings in portions of the thyroid glands removed from patients suffering from this condition. To what extent this pathological condition may return to normal in cases that have not been operated, it is, of course, impossible to say. There are certain facts, however, which would indicate that the thyroid gland may undergo pathological changes to such an extent as to produce a marked degree of hyperthyroidism, and that under favorable conditions, these pathological changes may subside sufficiently to leave the patient quite free from hyperthyroidism. Many such cases have been observed clinically, and we have a physiological condition which virtually duplicates these pathological changes, and which in most instances, ultimately leaves the patient and her thyroid gland in a perfectly normal condition. I refer to the goitre of adolescence.

Many of the typical symptoms of hyperthyroidism, such as enlargement of the thyroid gland, extreme nervousness, a certain degree of tachycardia, a slight muscular tremor, more or less marked muscular weakness, sweating, and sometimes a slight amount of exophthalmos, may characterize this condition. Notwithstanding these symptoms, physical, mental and emotional rest, good hygiene, pure drinking water and the use of proper diet will result in the disappearance, in the vast majority of cases, of all the symptoms of hyperthyroidism, as soon as the physiological demand for an increased secretion of the thyroid gland for trophic purposes has disappeared. The necessity of the body

\* Read by invitation before the Philadelphia Academy of Surgery, May 8, 1916.



to produce marked increase in the size and form of the skeleton, in the breasts, and in other portions of the body, requires a physiological increase in the thyroid secretion during this period of adolescence. So long as there is a reasonable balance between the physiological demand and the physiological secretion, no permanent harm seems to come to the tissues. On the other hand, if the balance is markedly disturbed because of some form of irritation, so that the secretion becomes quite excessive, then the tissues of the body seem to suffer permanently. Landstrom has shown that in all cases in which the hyperthyroidism has resulted in an actual dilatation of the heart, the condition of this organ never returns to normal, even though the removal of a sufficient portion of the thyroid gland to overcome the hyperthyroidism may result in a fairly normal pulse beat and in the disappearance of all other symptoms of hyperthyroidism.

Another illustration of physiological hyperthyroidism is quite common during the period of pregnancy, probably because an unusual amount of new tissue has to be produced as represented especially in the skeleton of the child. Here again, if the balance is not markedly disturbed, conditions almost always return to normal.

Wilms has pointed out an interesting form of hyperthyroidism which occurs in medical students coming from regions where goitre is endemic. He found that these students with greatly enlarged thyroid glands would enter the medical department of the university free from hyperthyroidism, but that in a relatively short time, a more or less marked condition of hyperthyroidism could be determined. His explanation is as follows: The hypertrophy of the thyroid gland is probably a physiological development for the purpose of protecting the individual against the harmful effect of goitre-producing substances contained in the drinking water of these regions. So long as this protection is needed because the individual continues to drink the infected water, hyperthyroidism is not present, but when these individuals go to the city in which the medical school is located and drink water that does not contain the goitre-producing substances, then the enlarged thyroid glands secrete superfluous thyroid substance which cannot be neutralized because of the absence of the irritating material in the drinking water, and consequently the symptoms of hyperthyroidism appear.

Morian has suggested that the normal thyroid gland takes the iodine which enters the human body through the food and changes it into organic iodine, and that when this form of iodine is supplied to the human body through the stomach in the form of thyroid extract in large quantities, or in the form of potassium iodide, that then the thyroid



## EXOPHTHALMIC GOITRE

gland may produce an abnormal amount of this organized iodine; that, on the other hand, the thyroid gland in patients suffering from hyperthyroidism without the ingestion of an abnormal amount of iodine has the peculiar ability of flooding the system with an abnormal iodine product which has the poisonous effect producing the recognized symptoms of hyperthyroidism.

There can be no doubt but what the thyroid gland can be forced to produce an excessive amount of a substance causing a condition which Moebius has called hyperthyroidism, even though the gland had previously supplied only a normal amount of secretion. Ordinarily this increase is the result of some form of physical or mental or emotional irritation. I have personally observed it as a result of extreme physical or mental or emotional exhaustion caused by conditions so varied in character that it seems doubtful whether there can be any cause of such exhaustion which may not result in hyperthyroidism.

The conception of hyperthyroidism by Moebius thirty years ago, if accepted, would naturally have led to the surgical treatment of exophthalmic goitre, had it not been for the fact that the condition of the patient's heart in cases suffering from exophthalmic goitre would naturally be looked upon as a contra-indication to any serious operation. Fortunately, von Rehn had removed two goitres in 1884, notwithstanding the presence of the typical symptoms of exophthalmic goitre, not for the purpose of correcting these symptoms, but for the purpose of curing the goitre to whose presence these symptoms had not been attributed, and, to his astonishment, he found that the patients did not only recover from the goitre operation but also from the symptoms which we now attribute to hyperthyroidism. So that two years later, when Moebius brought out his theory, the foundation for surgical treatment of exophthalmic goitre had already been laid.

I performed my first operation for the relief of exophthalmic goitre in 1891, twenty-five years ago, and repeated the observation which von Rehn had made. The patient's pulse, which had been one hundred and forty beats per minute before the operation, came down to seventy beats during the time that the patient was in the hospital, and the patient has constantly remained normal, so far as any symptoms of hyperthyroidism are concerned, since that time.

About six years ago my attention was directed to the interesting histological findings in specimens of thyroid gland tissue removed from patients suffering from exophthalmic goitre, in a paper read by Louis B. Wilson. I have personally examined carefully the microscopic sections of every thyroid gland which I have removed since that time from

patients suffering from exophthalmic goitre, 507 in all. I can confirm, in a general way, the interesting observations made by Wilson. Dr. Spensely, of the Chicago University, has also made extensive studies which will probably still further clear up this part of the subject. In a general way, every thyroid gland taken from a patient suffering from exophthalmic goitre shows unmistakable evidence of structural conditions which account for increased secretion and for increased absorption of this substance. In many instances, the first section we have examined has failed to show the structural changes, but we have invariably been able to find in some portion of the gland removed, lobules which showed this characteristic hyperplasia, which in many cases is quite circumscribed, while the greater portion of the gland removed may show simple hypertrophy or colloid enlargement.

The subsequent history of cases in which the thyroid gland has been removed for the purpose of relieving the condition of hyperthyroidism has also confirmed the correctness of the theory of Moebius.

*Surgical Treatment.*—The consideration of exophthalmic goitre by the clinical surgeon begins at the point at which it ends for the practitioner of internal medicine. The patient suffering from this disease should not be considered a surgical patient until the fact has been established that she cannot be permanently relieved of the disease as a result of carefully applied rest, both physical and mental as well as emotional, until a carefully regulated diet has been employed for a reasonable length of time, until she has been subjected to the best possible hygienic conditions that can be obtained for a person in her circumstances, and until the few remedies which seem to be of value in the treatment of such cases have been thoroughly tried.

It might be stated at this point that these remedies should never include the use of thyroid extract, the use of digitalis, or the use of iodine, although the very minutest doses of the last remedy mentioned may at times be harmless, but probably also useless. We have seen a number of deaths that could be fairly attributed to the use of each of these three remedies, and we have never seen a case in which one of these remedies, or any combination of them, has been of the slightest benefit to the patient.

In speaking of the dietetic treatment, not only before, but also during, the time that these patients are under surgical care, and above all things, after the surgical treatment has been concluded, too much stress cannot be laid upon the importance of giving these patients an abundance of absolutely pure drinking water, or, if this is not available, upon insisting that all water taken by the patient be carefully boiled.

## EXOPHTHALMIC GOITRE

Limiting surgical treatment to patients belonging to the class which is covered by the above definition, the time of operation must next be considered. Too frequently the patient and her friends and her family physician become convinced that she requires surgical care because this promises the only hope for her recovery, at a time when the patient is at the height of a period of exacerbation. Under the supposition that the sooner the patient can obtain the benefit of surgical relief the better it will be for her, an immediate operation is planned. Surgeons with a large experience in the treatment of these conditions are agreed upon the fact that this plan must result in a considerable number of avoidable fatalities, because these exacerbations are almost invariably followed by a lull in the severity of the condition, and if this period is awaited, the margin of safety is widened to an amazing extent and the percentage of mortality is correspondingly reduced. By a margin of safety one would mean in these cases a condition which would make it almost certain that the patient under consideration will recover in case the operation is performed, and the more nearly certain the surgeon can be of this, judging from the condition of the patient at the time of the operation, the wider would be the margin of safety. This margin of safety, however, depends not only upon the condition of the patient herself, but also to a large extent upon her mental attitude, upon which Crile and others have laid so much stress. If the patient is not thoroughly convinced that she will recover if the operation is performed, her chances of recovery are greatly diminished, and if the patient is at all frightened at the time for which the operation has been set, this should be postponed until she has attained the necessary confidence.

In cases in which the margin of safety does not seem sufficient to warrant the excision of a sufficient amount of the diseased thyroid gland to promise a complete and permanent recovery to the patient, the surgeon should limit his operative work to the amount that the patient can safely bear. If it seems safe to remove one lobe, that should be done. If it seems safe only to ligate one or two or three of the principal arteries and veins, then this should be the limit of the operation. It is in determining the extent of the operation that the patient can safely bear, that the surgeon has an excellent opportunity of showing surgical judgment in the treatment of these cases.

It has seemed to us that ligations of vessels have been more effective if the regular horse-shoe incision is made, that one uses in performing thyroidectomy, and if the enlarged veins located anteriorly to the thyroid gland are all clamped and ligated, as well as the superior and inferior thyroid arteries and veins on the side of the gland most infected,



effect, but its most important use lies in the fact that it prevents the accumulation of mucus in the pharynx and thus prevents the inspiration of mucus during the operation. Since we have employed this method our patients have been entirely free from ether pneumonia.

There is still a further method by means of which the amount of ether necessary can be greatly reduced. If the patient is thoroughly anæsthetized before the operation is begun, and if then the head of the table is elevated so that the body of the patient takes a position of forty-five degrees, the resulting anæmia of the brain will keep the patient anæsthetized for a sufficient period of time to enable the surgeon to perform the entire operation, from the time of making the first incision to the time of placing the last suture, without giving the patient any additional anæsthetic. Consequently, the patient will exhale ether throughout the period occupied for performing the operation without taking in any additional ether, and as soon as the head of the table is lowered, the patient is quite fully awake, and after the dressing is applied and the patient is placed in her bed, she is quite sufficiently awake to be permitted to sit up, which will further prevent the occurrence of ether pneumonia. Unless this precaution is taken, the patient is often returned to her bed quite saturated with ether, her pharynx is likely to be filled with mucus, and there is frequently a severe irritation of the larynx because of the manipulations necessitated by the operation, and the chances of ether pneumonia are very much greater.

Before returning the patient to her bed, it is of the greatest importance in all cases that have shown marked symptoms of hyperthyroidism to perform gastric lavage, using water at a temperature of 110° F. for this purpose. The mucus which accumulates in the stomach seems to increase the post-operative hyperthyroidism, and patients in whom gastric lavage has been made according to the method described seem to suffer very much less from this post-operative complication.

In order to eliminate entirely the danger from the anæsthetic, thyroidectomy may be performed under local anæsthesia by the use of  $\frac{1}{2}$  of 1 per cent. of novocaine with five drops of adrenalin chloride, 1 to 1000, to 1 ounce of the novocaine solution. If the surgeon's personality enables him to have a quieting effect upon the patient to such an extent that she will not suffer mentally from having the operation performed while awake, this method has many advantages. It has the further advantage of preventing traumatism. Many surgeons will perform an operation under local anæsthesia with almost no traumatism, while they habitually traumatize the tissues to a marked extent when operating upon the anæsthetized patient. In case the surgeon is habitually

## EXOPHTHALMIC GOITRE

and if the patient seems to be in sufficiently good condition, the superior thyroid artery and vein on the opposite side may be ligated at the same time.

As to the use of boiling water in those cases in which the margin of safety is too narrow to warrant a more extensive operation, in a few patients in whom we have tried this we have been very well pleased with this operation, but our experience is too limited for us to speak authoritatively on this subject.

Whatever the preliminary operation may be, however, it seems wise to give the patient the same careful after-treatment as though a radical operation had been made and to make the radical operation when the patient has obtained the greatest amount of benefit from the preliminary operation. Whenever we have failed to make the radical operation because of the apparent improvement after the preliminary operation, we have been disappointed in the ultimate result, because all of these patients have relapsed; while if we have removed the offending gland after the patient has picked up following the preliminary operation, our results have been eminently satisfactory.

This margin of safety can be enormously widened by administering from 400 to 600 c.c. of normal blood at the beginning of the operation for the excision of a thyroid gland by means of the modified Kimpton tube, which was introduced by my colleague, Dr. N. M. Percy. The blood can be introduced into one of the anterior jugular veins. This portion of the operation requires less than ten minutes and can consequently not increase the danger of the operation itself, while it improves the patient's condition enormously. Of course, it is important to have the donor's blood examined in order to choose a donor whose blood will not cause hæmolysis when introduced into the patient's vein.

Next to this comes the danger from the use of anæsthetics. The only general anæsthetic that seems safe to use in these cases by surgeons in general, is ether administered by the drop method. It is, however, very much better to give the patient a hypodermic injection of  $\frac{1}{4}$  grain of morphia and  $\frac{1}{100}$  grain of atropin one-half hour before the anæsthetic is begun. The advantage of this practice lies in the fact that the patient becomes quiet, is not sensitive to the consideration of the impending operation, and throughout the operation she is far less sensitive to pain, and consequently the total amount of ether which it is necessary to administer is very much less than it would be were this preliminary treatment omitted. Moreover, the patient will be returned to her bed with almost no ether in her circulation, while without this, she will be saturated with this poison. The atropin has also a quieting

violent in his surgical manipulations he should perform his thyroidec-tomies under local anæsthesia. There can be no doubt but what the likelihood of post-operative hyperthyroidism is greatly increased if the tissues are severely traumatized.

The loss of blood seems to have the same effect. It is consequently wise always to clamp each vessel between two hæmostatic forceps, cut between these and ligate. In this manner the entire operation may be performed with the loss of almost no blood, and the field of operation being constantly clean and free from blood, the surgeon is enabled to perform the operation with much greater facility. The tissues at the close of the operation will not be saturated with blood, the absorption of which according to Kocher also increases the likelihood of hyperthyroidism. For the same reason it is well invariably to apply drainage to these cases. Of course, all of these precautions are important from the stand-point of preventing shock at the same time that they prevent hyperthyroidism.

A great deal has been written and said concerning the importance of preventing injury to the recurrent laryngeal nerve and the parathyroid gland. In studying the literature of the subject, I have been struck by the fact that the surgeons who expose these structures for the purpose of protecting them, by laying bare the inferior thyroid artery and ligating the latter at a point external to its crossing the recurrent laryngeal nerve, are likely to have a considerable amount of paralysis of the recurrent laryngeal nerve at least temporary in character; because laying bare the recurrent laryngeal nerve, which is not much larger than an ordinary sewing thread, is very likely to result in an injury to this delicate structure. The ligation of the inferior thyroid artery at this point is likely to interfere with the blood supply of the inferior parathyroid gland, because this structure frequently obtains the greater portion of its blood supply from a branch of the inferior thyroid artery internal to this point. Injury to both of these important structures can, however, easily be prevented by bearing in mind the fact that both of these structures are located at the point at which the lateral lobe of the thyroid gland touches the trachea, and that they are both located behind the posterior capsule of the thyroid gland. Consequently, if the inferior thyroid artery is grasped in front of the posterior capsule of the thyroid gland, and if the portion of the posterior capsule of the thyroid gland is left undisturbed over the area at which the thyroid gland and the trachea are in close apposition, it is quite impossible to injure either the recurrent laryngeal nerve or the inferior parathyroid gland. Occasionally, however, one encounters aberrant arteries in this region, and in this case



## EXOPHTHALMIC GOITRE

one often has quite a little spurt of blood from one of these structures, and in applying forceps for the purpose of stopping this little hemorrhage it is quite possible to grasp through the posterior capsule and to injure one or both of these two important structures.

The veins in exophthalmic goitre are often so greatly dilated that it is well to bear in mind the possibility of air embolism in case one of these veins should be cut during inspiration of the patient and should be held open accidentally by means of forceps. It is also important to guard against rapid injection of novocaine in these cases because there is danger of forcing a considerable quantity of this fluid into a vein which might carry it to the heart, causing immediate death as a result of inhibiting the heart's action.

In patients who have suffered from the presence of a simple goitre for many years, in whom some portion of the goitre has later degenerated into the exophthalmic form, it occasionally happens that the old hard goitre has caused an absorption of one or more tracheal rings, and when the goitre has been removed, the trachea may collapse. If this occurs, the trachea should immediately be opened and a cannula should be inserted.

*After-treatment.*—By far the most important point in the surgical consideration of this condition consists in the after-treatment, because with careful after-treatment almost all of these patients may become nearly as useful as they were before they began to suffer from exophthalmic goitre, while in cases in which the after-treatment is not carefully carried out, practically all of these patients develop a condition as bad, if not worse, than that with which they presented themselves primarily for surgical treatment. The surgeon should bear in mind in the first place that practically all of these patients belong to a class of neurotics, and that this undoubtedly had much to do with the development of their goitres primarily, and that unless this condition is carefully taken into consideration in the after-treatment, the weakened physical condition of the patient will not be able to bear the wear and tear to which the neurotic tendencies would surely expose the patient. The same is true concerning the diet which is habitually chosen by the patients, which is usually exceedingly unwholesome, and it is consequently important that they be impressed with the fact that unless they will adhere to the use of a reasonable diet, their chances for a permanent recovery will be very slight. We have always given these patients printed directions which contain all of the important rules to be observed, and we have advised the patients to read these directions at regular intervals and to follow them for many years. The following is

ALBERT J. OCHSNER

a copy of the directions which we use in these cases, and which have proved eminently satisfactory. The patient receives a mild tonic and a laxative and an absolute diet list upon leaving the hospital.

RULES FOR GOITRE PATIENTS

1. You should avoid all excitement or irritation like attending receptions, shopping, church work and politics.
2. You should get an abundance of rest, by going to bed early and taking a nap after luncheon.
3. You should have an abundance of fresh air at night, consequently, you should sleep with wide open windows or on a sleeping porch.
4. You should eat and drink nothing that irritates the nervous system, like tea, coffee, or alcohol. Of course you should not use tobacco in any way.
5. You should eat very little meat. If you are very fond of meat, take a little beef, mutton or breast of chicken or fresh fish once or twice a week or at most three times a week.
6. You should drink a great deal of milk or eat things that are prepared with milk, such as milk soup, milk toast, etc., cream and butter-milk are also especially good for you.
7. You should avoid beef soup or beef tea or any kind of meat broths.
8. You should eat an abundance of cooked fruits and cooked vegetables, or very ripe raw fruits, or drink fruit juices prepared out of ripe fruits.
9. You may eat eggs, bread, butter, toast, rice, cereals.
10. You should drink an abundance of good drinking water, or if this is not available, you should boil your drinking water for twenty minutes or drink distilled water.

With the exception of a very small number of cases in which an insufficient amount of the gland had been primarily removed, or in which the remnant which had been left at the primary operation had increased in size, in practically all of the cases which have come to us with a recurrence, either from among those that we had personally operated or those that had been operated by other surgeons, we have almost invariably found that they had either disregarded the directions given regarding diet and rest and hygiene following their operative treatment, or they had been permitted to return to their homes without definite instructions in this direction. It is therefore very important that written or printed directions be given these patients and that they be thoroughly impressed with the importance of using these directions.

## THE SURGICAL TREATMENT OF GOITRE\*

HOW CAN THE RESULTS ACHIEVED BE IMPROVED?

BY MILES F. PORTER, M.D.  
OF FT. WAYNE, IND.

My title presupposes two things. First, that the results achieved in the surgical treatment of goitre are not satisfactory. Second, that it is possible to improve upon the results heretofore achieved in the surgical treatment of goitre.

It will not be necessary for me to occupy your time or try your patience in presenting proof of the first assumption. You need only recall your own experiences together with the results reported from other sources to bring you into entire agreement with it.

We shall proceed, therefore, at once to consider the various causes of failure in the surgical treatment of goitre and the possible means of avoiding them. We find that a certain percentage of cases of toxic goitre (and I use the term toxic here to include exophthalmic goitre) die without operation; a certain percentage die as a result of operation; another small percentage die in spite of operation, or after operation as the result of recurrence.

Quite a number of those cases of goitre which die without operation have been refused operation largely on the ground of other pathological conditions, among which diabetes and nephritis hold a prominent place. The coexistence of either nephritis or diabetes with hyperthyroidism should be considered rather as an argument for than against operation. O'Day<sup>1</sup> and others have shown that the cure of hyperthyroidism by surgical measures has been followed by the disappearance of sugar from the urine in these patients and the establishment of a normal sugar tolerance, while the disappearance of the signs of kidney inadequacy coincidently with those of hyperthyroidism has frequently been observed.

According to Rogers,<sup>2</sup> "only about 25 per cent. of cases of hyperthyroidism are improved by hemithyroidectomy, and some 10 per cent. of them are not benefited at all or made worse, and the general operative mortality is at least 5 per cent." I feel that the number of deaths from goitre, including those following operation and those occurring without

---

\* Read by invitation before the Philadelphia Academy of Surgery, May 8, 1916.



operation, would be reduced if judicious surgery were employed earlier and more frequently. A more careful search for the vascular phenomena in cases of possible hyperthyroidism may enable one to reach a diagnosis earlier than could otherwise be done. Osler<sup>3</sup> has pointed out the fact that a thrill may be present in the thyroid when the gland is not enlarged. Riesman<sup>4</sup> has recently called attention to a bruit over the eyeball that may be an aid in diagnosis. Rogers,<sup>5</sup> in discussing the subject of goitre before the New York Surgical Society, April 10, 1912, said that excision should never be done in symmetrical enlargement of the thyroid nor in thyroid enlargement in the young, and that the same rule applied in colloid goitre as well as to the goitre of Graves's disease. Of course, no one would advise general or even frequent resort to surgical treatment in goitre occurring in young girls, but in the writer's opinion this teaching, without material qualification, is pernicious, for the reason that in his experience goitre occurring in boys is quite as apt to continue and to give trouble as is goitre occurring at a later age, while some of the most severe cases of toxic goitre that he has seen occurred in women who had carried their goitres from puberty, and the history clearly shows in many of these cases that there was a time when proper surgical treatment might have been carried out with less risk and much greater assurance of a satisfactory result than when they finally submitted to operation. It should be the rule to remove all permanent goitres whether they are producing symptoms or not. Were this rule followed there would be fewer cases of toxic goitre. Personally, I believe that there is as much reason for removing so-called simple goitres with a view to preventing them from becoming toxic as there is for removing or curing by surgical means certain lesions, such as warts, moles, and chronically inflamed areas, to prevent them from becoming malignant. If this rule were followed it would largely eliminate the deaths from so-called degenerating simple or toxic goitre. And it will be remembered in this connection that C. H. Mayo and Plummer<sup>6</sup> place the death-rate in this form of goitre at least 2 per cent. higher than that which obtains in the exophthalmic type.

The authors above quoted place the number of recurrences after operation at 10 per cent. To me it seems the part of better judgment to remove a larger part of the thyroid than is usually done, even at the risk of producing hypothyroidism, for the purpose of preventing recurrence and achieving more complete relief. Personally, for some years, I have not been content with doing a so-called lobectomy, but have removed in all cases from five-sixths to nine-tenths of the gland.

## THE SURGICAL TREATMENT OF GOITRE

This experience covers more than 100 cases and in none, so far as my knowledge goes, has there been either recurrence or symptoms of hypothyroidism.

On the other hand, within that period I have been called upon to do a number of secondary operations for patients who had previously had one lobe of the gland removed. Frequently not more thyroid tissue has been allowed to remain than would correspond in size to the half of my thumb. Another argument in favor of more complete removal of the gland is the failure to get relief from so-called hemithyroidectomy. According to Rogers,<sup>7</sup> these failures amount to 10 per cent. It seems hardly necessary for me to say that this relatively complete thyroidectomy is not advised in cases wherein it adds seriously to the risk of the operation. In such cases the operation would better be done in two stages. It is well to add here that if relatively complete thyroidectomy were substituted for lobectomy, not a few cases of malignancy would be permanently cured that otherwise would go on to a fatal end. Because of the especial frequency of malignant degeneration in nodular goitres, especial care should be taken to remove all nodular areas completely when doing a thyroidectomy (Figs. 7, 8 and 9). Not frequently deaths occur from hyperthyroidism following operations for the cure of other troubles. Naturally these accidents are growing less frequent, because surgeons are less apt to overlook mild symptoms of hyperthyroidism in these days than formerly. However, that these unfortunate accidents have not been entirely eliminated is proven by the following case, which is under my care at the present writing, suffering with a severe hyperthyroidism of the exophthalmic type.

Mrs. B., aged fifty-two, married, mother of three children, consulted me on March 30, 1916, presenting all of the symptoms of an aggravated type of exophthalmic goitre. Previous and family history were unimportant save for the following: One year prior to her visit to me she had been operated upon for gall-stones. Two days after the operation she suddenly developed severe symptoms of cardiac failure, and for some days it was thought she would die. She said she had one similar attack, not so severe, before she had her operation for gall-stones, but first noticed the enlargement of her neck six months after her gall-stone operation. Had this woman been treated for her hyperthyroidism first and subsequently operated for her gall-stones, it is fair to assume that she would now be enjoying good health.

At this point in the preparation of this paper I was consulted by a very intelligent woman in behalf of the widow of a doctor

living in California, regarding the advisability of an operation for goitre. The goitre has existed since girlhood, but never gave her any trouble until quite recently, since which time it has been "bothering her heart." She is the mother of three grown children, and within the last five years she had undergone two surgical operations, the exact nature of which could not be ascertained.

Cases like this and the one above noted are quite common. The first serves to emphasize the desirability of being on the lookout for symptoms of thyroid intoxication in patients upon whom we are about to operate for other conditions, while the second case serves to emphasize the same point; but more particularly to my mind does it emphasize the point brought out earlier in the paper, namely, the desirability of removing all permanent goitres whether they are giving rise to symptoms or not.

There remain to be discussed three sources of dissatisfaction following thyroidectomy, viz.: First, failure to get relief from the symptoms, although there be no recurrence of the goitre. Second, the immediate mortality is too high. Third, too many cases are seen which have gone beyond the point where the question of surgical relief can be entertained with reason.

The first cause of failure or partial failure can be avoided quite often by making a liberal incision and exposing the whole gland before commencing its removal. This will enable one to avoid injuring either the nerves or the parathyroids, and permit one to judge with reasonable accuracy as to the amount of gland tissue left and especially its character. This latter is important, for it is quite possible that failure to get relief after partial thyroidectomy is due to the fact that the trouble-producing part of the gland has not been removed. Very often and perhaps in the majority of cases by careful examination of the gland after uncovering it, it is possible to distinguish the hyperactive or toxic portions of the gland from the inactive or normal portions. The hyperactive and toxic portions are lighter in color, yellowish white rather than red, and not so firm as the normal gland structure. One should endeavor to remove all pathologic tissue and allow to remain only normal tissue in so far as it is possible, and where no healthy gland tissue is found, I think one is warranted in leaving only a very small part of thyroid tissue behind, for it is logical to assume that less hyperactive than normal gland tissue is necessary to perform the physiological function of the thyroid. My observations along these lines have not as yet gone far enough to warrant me in speaking at all dogmatically, but do warrant the suggestion made.



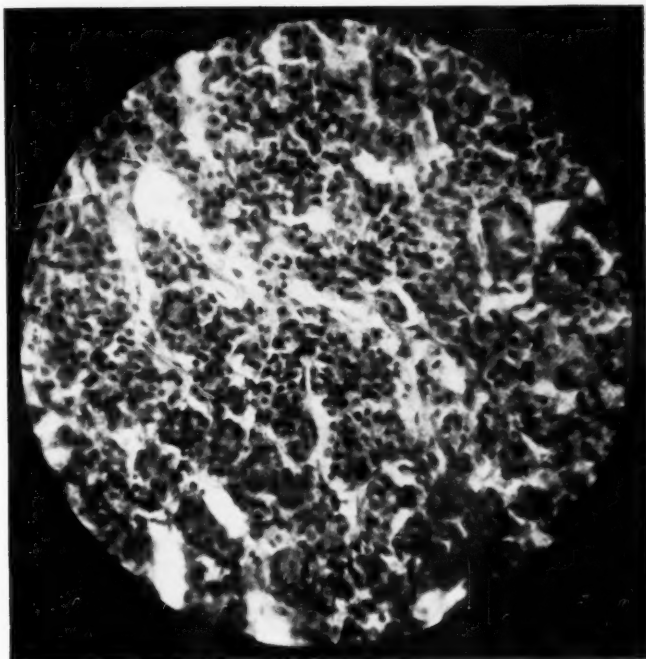


FIG. 1.—Miss B. Taken from the pale portion of the gland. Note the hyperplasia and compare with Figs. 2 and 3.

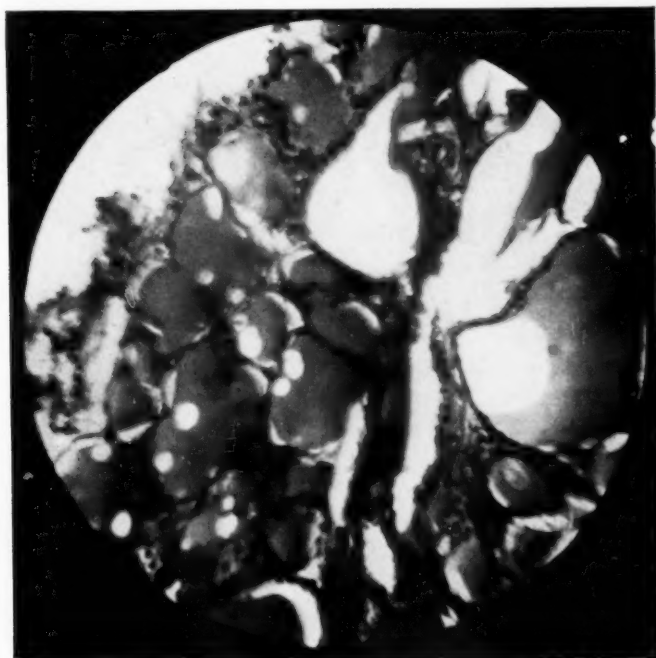


FIG. 2.—Miss B. Section from red portion of thyroid, showing very little hyperplasia and much colloid.

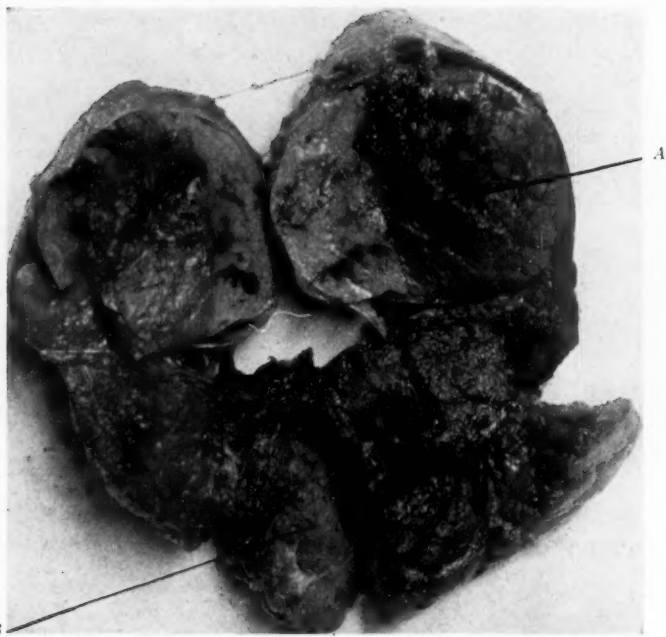


FIG. 3.—Miss B. Photograph of section through gross specimen, showing encapsulated tumor (A) in upper half of the picture and dark normal thyroid below (B). The tumor contained the trouble-producing tissue and was very much lighter in color and less firm than the non-hyperplastic portion.

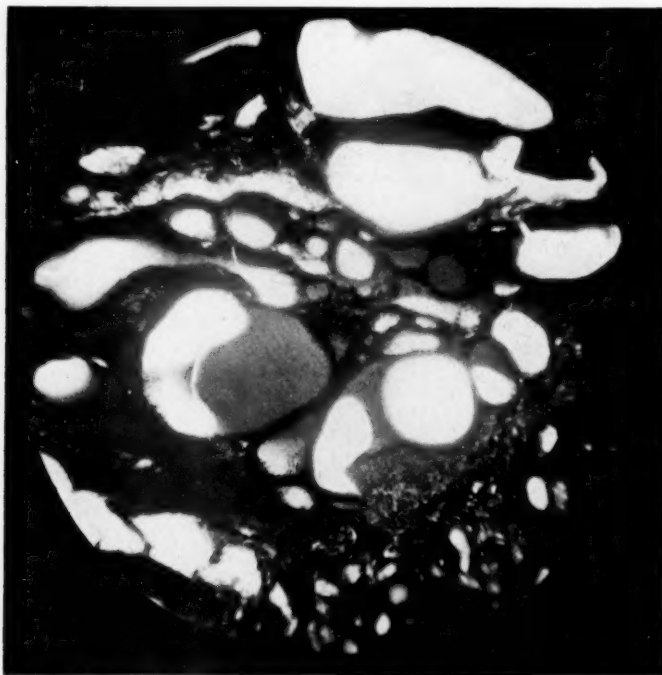


FIG. 4.—Miss D. Section from red portion (see Fig. 6, A) of gland, showing simple goitre.

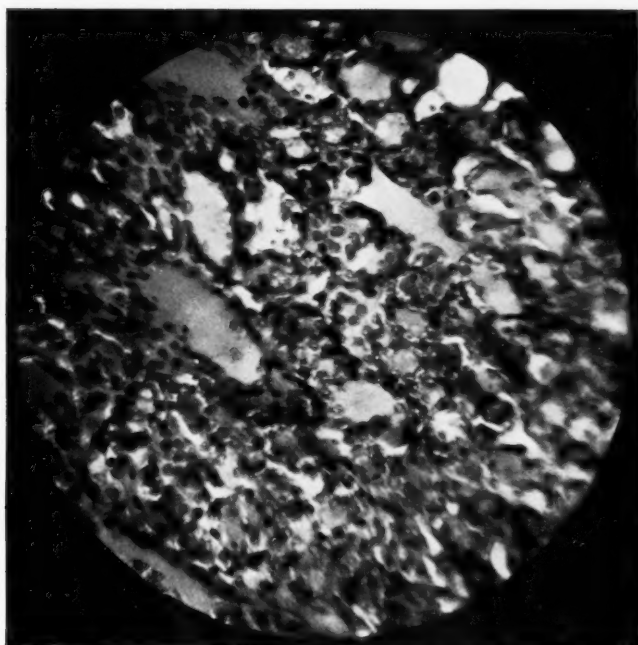


FIG. 5.—Miss D. Section from lighter part of gland (Fig. 6, C and B), showing hyperplasia.

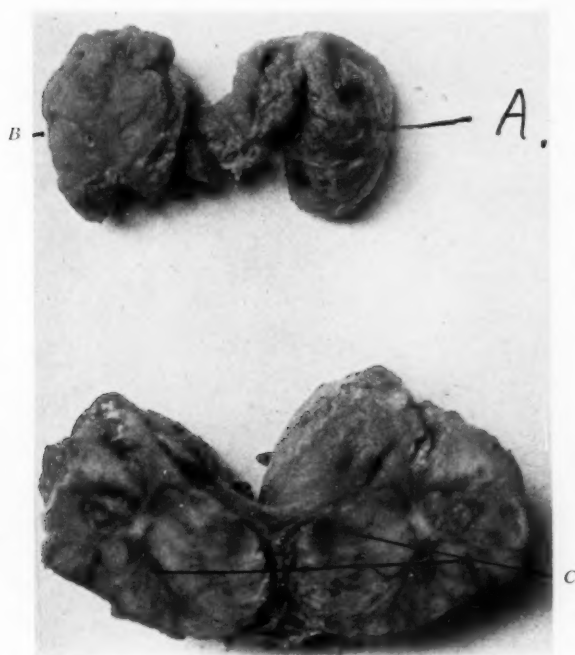


FIG. 6.—Miss D. A is the dark and B the light lobe, from which Figs. 4 and 5 were made. C shows gross section through lighter portion of the gland.



FIG. 7.—Mrs. S. Shows two views of gross appearance of the thyroid. The nodular condition suggests malignancy, while the light color prevailing suggests hyperplasia. This case presented aggravated symptoms of hyperthyroidism with exophthalmos. Compare with Figs. 8 and 9. In this case the toxic symptoms and malignancy developed in a goitre of long standing. A timely operation in this case might have prevented both the toxic symptoms and the malignancy.

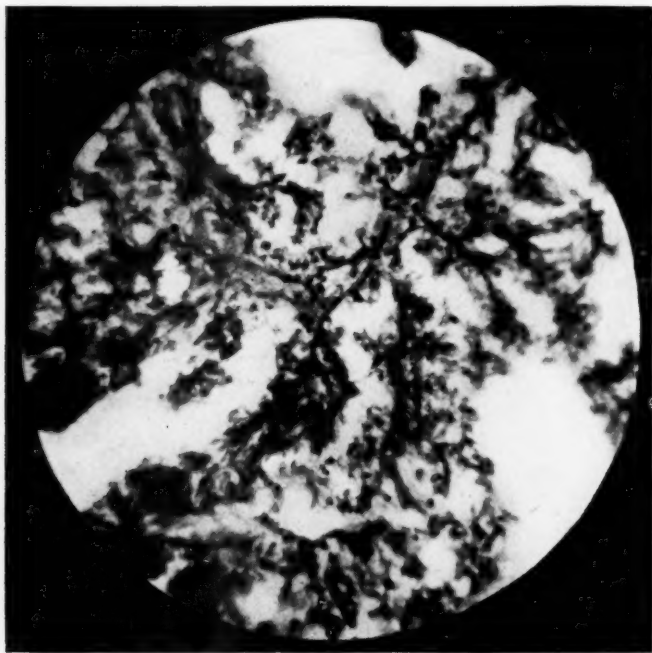


FIG. 8.—Mrs. S. Section showing hyperplasia with cytotoxicity.



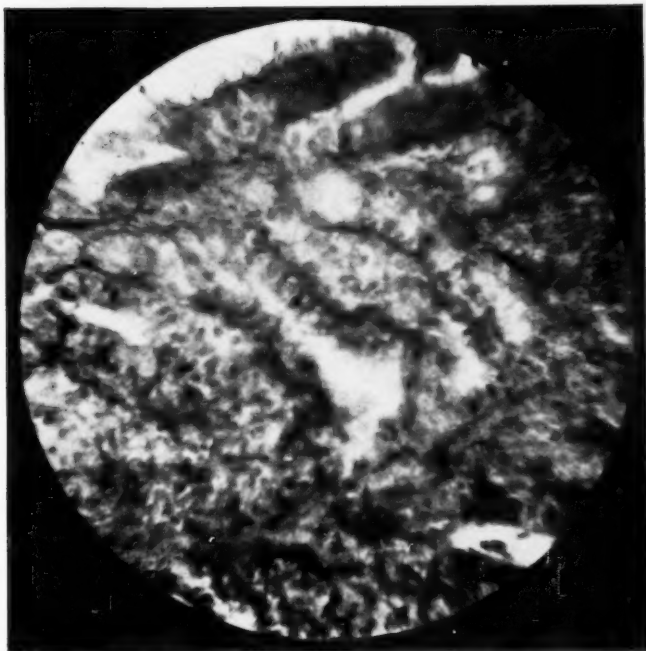


FIG. 9.—Mrs. S. Section showing hyperplasia of malignant adenomatous type.



FIG. 10.—Mrs. M. Showing surface and contour of gross specimen (A) and gross section (B). This was a goitre of long standing in which symptoms of hyperthyroidism later developed. In B may be seen the white spots and streaks indicative of fibrous and calcareous changes.

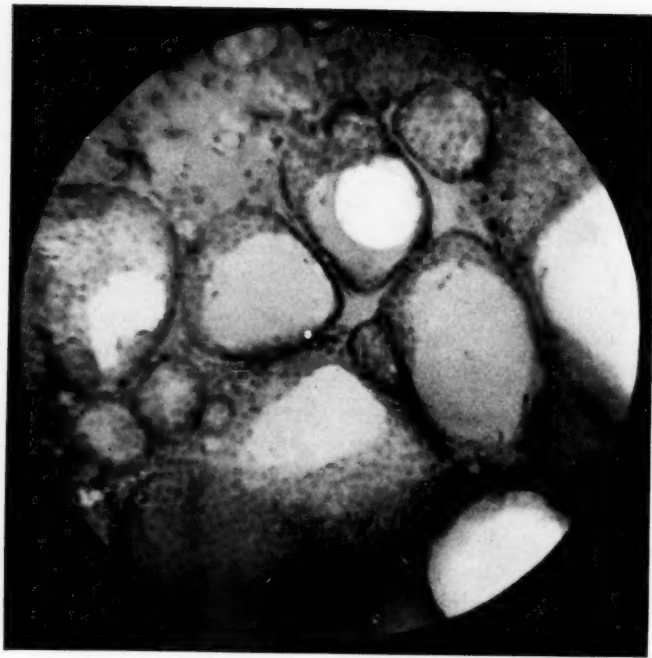


FIG. 11.—Mrs. M. Section showing marked hyperplasia.

## THE SURGICAL TREATMENT OF GOITRE

Figs. 1, 2, 3, 4, 5, 6, 10 and 11 illustrate very clearly the macroscopic and corresponding microscopic differences found in normal or inactive goitre tissue, on the one hand, and hyperactive and toxic goitre tissue on the other. I have made no attempt to keep an accurate account of the cases in which this differentiation can be made at operation, but am certain it can frequently be done. Since this paper was commenced I have been able to make it in 2 of the 4 cases operated within that period.

The immediate mortality of operation can be reduced by substituting boiling water injections into the gland for ligation as a preliminary to thyroidectomy in serious cases, and by using the injections to the exclusion of all operative methods, in mild cases with little or no enlargement of the thyroid, and in extremely grave cases. One or two injections will cure the mild cases and will give as much relief in the extremely grave cases as thyroidectomy and at a much less risk. In some of these extremely grave cases one is surprised by getting a satisfactory result, while in others the result is satisfactory save that the deformity is still disfiguring, and this can now be removed by operation without undue risk. In those cases in which there need be no fear of a slight operation it is better to uncover the isthmus of the gland by a small incision under novocaine and inject both lobes under guidance of the eye. With our present state of knowledge in a certain percentage of cases a certain mortality is perhaps inevitable once the symptoms have become at all pronounced. In my experience anorexia, diarrhoea, and mental derangements are especially unfavorable symptoms. I know of no way of distinguishing between the cardiac symptoms due to myocardial changes and those due to toxæmia. I would like to repeat here a statement made in the earlier part of this paper, to the effect that this so-called inevitable mortality could be reduced by removing all simple goitres before they become either toxic or malignant.

### REFERENCES

- <sup>1</sup> O'Day: American Jour. Surg., Gynæcology and Obs., vol. xxii, p. 206, February, 1916.
- <sup>2</sup> Rogers: ANNALS OF SURGERY, vol. lvi, p. 459, 1912.
- <sup>3</sup> Osler: McRea, Modern Medicine, vol. iv, p. 859, second ed.
- <sup>4</sup> Riesman: Jour. Am. Med. Assoc., vol. lxvi, No. 18, p. 1381.
- <sup>5</sup> Rogers: *Loc. cit.*
- <sup>6</sup> Mayo and Plummer: Progressive Medicine, vol. xix, No. 1, p. 88, 1916.
- <sup>7</sup> Rogers: Progressive Medicine, vol. xix, No. 1, p. 84, 1916.

## RESULTS OF OPERATIVE TREATMENT OF EXOPHTHALMIC GOITRE \*

BY VERNON C. DAVID, M.D.  
OF CHICAGO, ILL.

OF two hundred successive cases of exophthalmic goitre operated upon at the Presbyterian Hospital, Chicago, prior to December, 1914, eleven, or 5½ per cent., died in the hospital. To ascertain the condition of the patients who had been operated more than a year a series of questions were addressed to them. Owing to a new system of street numbering instituted in Chicago a few years ago many of our letters failed to reach the patients, but sixty-five answers were received. An effort will be made to correlate the condition of these patients before operation with their present status of health. Three divisions can be made according to the severity of the symptoms of hyperthyroidism recorded in the history sheets.

Group 1. Moderate symptoms of hyperthyroidism, such as nervousness, palpitation and tachycardia with a pulse rate of 90 to 100, goitre and perhaps exophthalmos were present, but there was no evidence of severe intoxication. There were six cases of this type. Lobectomy was done in all of them. Three patients were cured and three were greatly improved but were still nervous. Two patients had exophthalmos before operation and in both instances it disappeared after operation.

Group 2. These patients had marked symptoms of hyperthyroidism with a pulse of 100 to 120, tremor, exophthalmos, weakness, nervousness and in most instances were unable to attend to their ordinary duties. In this group were thirty-five patients. Lobectomy was done in thirty-three and double ligation in two. Eleven, 31.4 per cent., were cured, fourteen, 40 per cent., were greatly benefited, eight, 23 per cent., were slightly improved and two, 6 per cent., showed no improvement. Twenty-four of the thirty-five patients are able to work and assume ordinary responsibility. Twenty patients had exophthalmos before operation and nine of these report its disappearance since operation. Six had had a simple goitre before the onset of their symptoms. In this group 21.6 months had elapsed between the appearance of symptoms and operation.

Group 3. Nineteen very severe types of hyperthyroidism are

---

\* From the Surgical Department of Rush Medical College.



## EXOPHTHALMIC GOITRE

placed in this group, with pulse over 120, great prostration, and with an exaggeration of all the well-known symptoms of hyperthyroidism. Lobectomy was done in all of these cases. Nine, 47.3 per cent., were cured, six, 31 per cent., were greatly improved, three were somewhat improved and one received no benefit from her operation. Fourteen were able to resume their ordinary duties. Of the nineteen cases fourteen had exophthalmos before operation and nine report themselves free from it. Seven had had a goitre before the symptoms of hyperthyroidism began. Symptoms were present on an average of 26.7 before operation.

Kuttner<sup>1</sup> reported the operative results in fifteen very severe cases of hyperthyroidism. Five were cured, eight much improved and able to work, and two were unimproved.

If we consider the entire group of sixty-five patients from whom we received adequate replies, thirty-two, 49 per cent., were able to attend to all duties, usual or extraordinary, twenty-one, 32 per cent., were able to attend to their ordinary duties but not able to assume unusual responsibility, and twelve, 18 per cent., are unable to work at all.

Twenty-five patients, 38 per cent., may be classed as well with no trace of their former subjective symptoms. The average duration of the disease in the cured patients before operation was 16.7 months and excepting three patients, was 9.8 months. Lobectomy was done in twenty-four cases and ligation in one. Fifteen had exophthalmos before operation and only six are relieved from it.

Classed as greatly improved but still nervous or having palpitation are twenty-six patients, or 40 per cent. of the total number. There were five in Group 1, sixteen in Group 2, and five in Group 3. The average duration of symptoms before operation was 23.1 months. Lobectomy was done in twenty-three, ligation in one and ligation with subsequent lobectomy in two. Exophthalmos was present in twelve before operation and is reported as cured in six.

There were twelve, 18.4 per cent., who showed some improvement from their operation, but were not well because of the insistent duration of some or all of the symptoms of hyperthyroidism. The average duration of symptoms before operation was twenty months. Eight patients had exophthalmos before operation and only one reports herself cured.

Three patients, two having lobectomy and one ligation, showed no improvement. The average duration of symptoms before operation was thirty-three months.

Of the sixty-five cases considered, twenty-five, or thirty-eight per cent., had had a goitre for months or years before the onset of symptoms of hyperthyroidism.

#### VERNON C. DAVID

Of the operative procedures lobectomy was done sixty times, curing twenty-four, greatly improving twenty-one, improving thirteen slightly, and failing to benefit two patients.

Kuttner<sup>2</sup> reported the end results of thirty-seven cases: 32.2 per cent. were cured, 36 per cent. were much better, 16 per cent. were improved and 13.8 per cent. showed no improvement; 82 per cent. were able to work.

Von Eiselsberg<sup>3</sup> reported seventy-one cases with six operative deaths. Lobectomy had been done in sixty-six cases; 32.3 per cent. were well except exophthalmos.

Judd and Pemberton<sup>4</sup> reported the end results in one hundred and twenty-one cases operated in 1909. Fifty-six were ligated, thirty-six had primary lobectomy and twenty had preliminary ligation followed by lobectomy; forty-five per cent. were cured, 18 per cent. practically cured, 12 per cent. were benefited and 5 per cent. received little or no benefit from the operation. The average length of time that symptoms had lasted before operation was about the same in all groups, varying from nineteen to twenty-two months.

In our cases 38 per cent. were cured and 40 per cent. were greatly benefited, while Judd and Pemberton report 45 per cent. cured and 23 per cent. greatly benefited, making in each instance 78 per cent. of all cases that received a marked benefit or cure from the operation.

#### SUMMARY

In sixty-five patients operated for exophthalmic goitre from 1905 through 1914, 38 per cent. were cured and 40 per cent. were greatly benefited.

Of thirty-five patients having exophthalmos before operation only thirteen, or 37 per cent., reported themselves relieved from it.

The duration of symptoms before operation in the patients cured was sixteen months, in those greatly benefited was twenty-three months, and in those not improved was thirty-three months.

#### REFERENCES

<sup>1</sup> Kuttner: Verhandl. d. deutsch. Gesellsch. f. Chir., 1911.

<sup>2</sup> *Loc. cit.*

<sup>3</sup> Verhandl. d. deutsch. Gesellsch. f. Chir., 1911.

<sup>4</sup> Surg., Gyn. and Obs., vol xxii, No. 3, p. 269, 1916.

## THE SURGICAL TREATMENT OF PERFORATED ULCER OF THE STOMACH\*

WITH ESPECIAL REFERENCE TO THE QUESTION OF IMMEDIATE GASTRO-ENTEROSTOMY

BY ABRAHAM O. WILENSKY, M.D.

OF NEW YORK

ADJUNCT ATTENDING SURGEON, MOUNT SINAI HOSPITAL, NEW YORK

(From the surgical service of Mount Sinai Hospital, New York: Dr. A. A. Berg)

THE most approved methods of operative treatment of chronic ulcer of the stomach or duodenum are thorough excision of the ulcer-bearing area and gastro-enterostomy. The application of either method will depend upon the character of the ulcer, its location in stomach or duodenum, and, lastly, upon the presence or absence of associated lesions. The influence which the addition of acute disturbance within the peritoneal cavity, produced by sudden perforation, will have in modifying either one of these methods of treatment, is the basis for this communication.

The ideal method of operative treatment of perforated ulcer of the stomach would comprise the closure of the perforation plus some procedure for the cure of the underlying ulceration. The feasibility of doing anything further than a purely life-saving measure *is determined by the general condition of the patient at the time of operation and by the extent and degree of the associated peritonitis.*

It should be conceded that those patients who come to operation in an advanced stage of the acute illness, when conditions are desperate, should without exception be subjected only to those operative procedures which are life-saving. These are (1) closure of the perforation, with adequate drainage of the peritoneal cavity; (2) when this is impossible, packing and drainage down to the area of perforation, in which event a second operation becomes imperative as soon as the condition of the patient permits; (3) rarely, as will be pointed out later, the making of a jejunostomy becomes the operation of choice.

A second group comprises those patients who are seen very soon after the perforation, who are in good condition and in whom, upon

---

\* Read at a Clinical Conference, Mount Sinai Hospital, January 27, 1916.

opening the abdomen, a serous exudate is found, perhaps localized to the upper right quadrant of the abdominal cavity.

Third, there is that largest group composed of patients who come to operation when the perforation is many hours or days old and who have much seropurulent or purulent exudate within the abdomen, the manifestations of the extent and severity of the accompanying peritonitis.

In these two latter groups the question of doing more at the primary operation than simple closure of the perforation arises.

Nineteen patients have been treated for acute perforation of the stomach or duodenum in the last two years, and this number includes sixteen men and three women.<sup>1</sup> The patients have all been between twenty-five and forty-five years of age. Nine of the total number died, making an immediate mortality of 47 per cent.

Most of the perforations were found near the pyloric sphincter, either in the stomach or in the duodenum, and several were found on the lesser curvature. None was found near the cardia. All of these had perforated into the general peritoneal cavity, so that at the time of operation the lesser peritoneal cavity was apparently not involved. In studying the records of these patients, the usual difficulty was always present of estimating from written descriptions the extent and severity of the accompanying peritonitis. The tissues of the stomach wall surrounding the perforation were either soft and pliable, and the stitches put in to close the perforation held very well, indicating that one had to deal with an acute perforating ulcer; or there was much induration present, and the closure became a matter of difficulty, indicating that the perforation had occurred in an ulcer of long standing.

present:

The following table shows the length of time prior to perforation during which symptoms referable to some stomach lesion had been

- In 4 patients perforation was the first symptom;
- In 5 patients symptoms had been present for periods up to 6 months;
- In 1 patient symptoms had been present for 1 year;
- In 2 patients symptoms had been present for 2 years;
- In 3 patients symptoms had been present for 6 years;
- In 1 patient symptoms were present for 10 years;
- In 1 patient symptoms were present for 15 years;
- In 2 patients the history is deficient on this point.

---

<sup>1</sup>There are no adequate data available at the present writing which explain this preponderance in the male sex. It is quite possible that this bears some relation to the etiological cause of ulcer of the stomach and duodenum.



## PERFORATED ULCER OF THE STOMACH

The lengths of the intervals between perforation and operation were as follows:

2 hours, 1 patient	30 hours, 1 patient
6 hours, 3 patients	36 hours, 1 patient
7 hours, 1 patient	48 hours, 1 patient
8 hours, 1 patient	72 hours, 1 patient
10 hours, 1 patient	5 days, 1 patient
12 hours, 3 patients	8 days, 1 patient
24 hours, 2 patients	unknown, 1 patient

Brief notes on the character of the treatment and the post-operative course, with the final result, are given in the following table:

Case No.	Interval after perforation	Operation	Post-operative course	Result
1	2 hours	Closure	Pneumonia developed, and on 9th day	Died.
2	6 hours	Closure and gastro-ent.	Uneventful	Well.
3	6 hours	Closure and gastro-ent.	Uneventful	Well.
4	6 hours	Closure and gastro-ent.	Uneventful	Well.
5	7 hours	Closure and gastro-ent.	Uneventful	Well.
6	8 hours	Closure and gastro-ent.	Had many other ulcers, one of which perforated on 33rd day	Died.
7	10 hours	Closure and gastro-ent.	Uneventful	Well.
8	12 hours	Closure and gastro-ent.	Uneventful	Well.
9	12 hours	Closure and gastro-ent.	Pneumonia developed, and on 7th day	Died.
10	12 hours	Closure	Died immediately	Died.
11	24 hours	Closure	Died 5 hours later	Died.
12	24 hours	Closure and gastro-ent.	Uneventful	Well.
13	30 hours	Closure	Uneventful	Well.
14	36 hours	Packed only	Duodenal leakage; later gastro-enterostomy	Died.
15	48 hours	Closure	Uneventful	Well.
16	72 hours	Closure and gastro-ent.	Death five hours later	Died.
17	5 days	Closure	Died immediately	Died.
18	8 days	Closure	Died immediately	Died.
19	Unknown	Closure	Uneventful	Well.

Comparing the interval between perforation and operation, we find that:

- Of those under 6 hours, 1 out of 4 patients died; mortality = 25 per cent.
- Of those from 6 to 12 hours, 3 out of 6 patients died; mortality = 50 per cent.
- Of those from 12 to 24 hours, 1 out of 2 died; mortality = 50 per cent.
- Of those from 24 to 48 hours, 1 out of 3 patients died; mortality = 33 per cent.
- Of those over 48 hours, 3 out of 3 patients died; mortality = 100 per cent.

As stated before, nine of the patients died. Five of these died within a few hours after the operation. The operation in four of these

patients consisted of simple closure of the perforation, and in the fifth, of closure of the perforation with immediate gastro-enterostomy. Two of the patients died on the seventh and on the ninth days, respectively, of pneumonia. One of the patients lived for thirty-three days after the operation; the post-mortem examination showed that there were many ulcers in the stomach in addition to the one that had been closed at the primary operation, and that there was a second perforation which communicated with an abscess cavity between the stomach wall and adjacent coils of intestine. The last of these fatal cases was treated by tamponade of the perforation. A duodenal fistula developed immediately, and, although a secondary gastro-enterostomy with unilateral exclusion of the pyloric antrum was done within a few days, the patient died.

We have been much interested in the question of adding gastro-enterostomy to the closure of the perforation at the primary operation. On our service, especially when one has to deal with perforation of the wall of the stomach or duodenum, it is believed that unilateral exclusion of the ulcer-bearing area would be demanded in addition. The reasons for this are noted below.

There are many things which may be said for and against gastro-enterostomy at the primary operation. The absolute indications for the performance of gastro-enterostomy in the presence of an acute perforation are:

1. Stenosis of the pylorus or duodenum. This may result from the presence of old or recent peripyloric or periduodenal adhesions accompanying pathological lesions in the indicated portion of the alimentary canal, or in a neighboring organ, such as the gall-bladder. Such adhesions are present fairly often. The stricture may be due also to extensive scarring of the wall of the stomach, or duodenum, produced by the healing of extensive ulcerations. Lastly, in exceptional instances, the lumen of the alimentary canal at the area of perforation may be compromised by the infolding of the wall necessary to the proper closure of the opening. This latter condition is in the main theoretical, inasmuch as it is universal experience that it is impossible to produce permanent narrowing of the calibre of the intestine at any part of its course by this method.

2. To safeguard insecure stitches. One might almost say that such an indication is present in every case because the closure of the perforation is necessarily made in infected territory.

3. When the perforation is only packed or drained, gastro-enterostomy, with unilateral exclusion of the area of perforation, is the

## PERFORATED ULCER OF THE STOMACH

only safe way of preventing the formation of a duodenal fistula. The development of such a condition (and if nothing is done for its prevention it will almost invariably develop) is a most serious and, in the greatest majority of the cases, a fatal lesion.

This condition was well illustrated by the following case: During the course of an operation for a perforated ulcer on the anterior surface of the duodenum, several unsuccessful attempts were made to close the opening. The condition of the patient becoming exceedingly desperate, nothing further was attempted, and the perforation was packed. A duodenal fistula resulted, and the condition of the patient deteriorated steadily. On the eleventh day a gastro-enterostomy was hastily done with a Murphy button and the perforated area was excluded by the string method. No further leakage occurred but, nevertheless, the patient succumbed some days later.

These are indications which can be met satisfactorily in no other way than by the performance of gastro-enterostomy with unilateral exclusion of the involved area. If, owing to the desperate condition of the patient, the gastro-enterostomy may not be done immediately, it will become imperative within a very few days, especially if duodenal leakage should develop. After such a delay the general condition of the patient becomes all the more compromised.

Gastro-enterostomy also offers the following advantages:

1. It facilitates the early nutrition of the patient.
2. It exerts a favorable influence upon the underlying ulcerated condition. Eliot<sup>2</sup> was able to collect seventy-five cases in which symptoms of ulcer continued after the recovery from the operation for acute perforation, and gastro-enterostomy had to be added later.
3. It diminishes the danger of subsequent hemorrhage or perforation in coexisting ulcers and favors their healing. There are records in the literature<sup>3</sup> of twelve patients in whom perforation occurred for a second time from other coexisting ulcers after the primary operation.

Objections that are made to the addition of gastro-enterostomy at the primary operation are:

1. It prolongs the operation and adds to the shock. In skilled hands, however, an anastomosis with the Murphy button can be made in ten minutes, or even less. However, as said before, the desperate cases are not considered as coming in the class of cases in which the question

---

<sup>2</sup> Eliot: ANN. SURG., Philadelphia, 1912, 55, 689.

<sup>3</sup> Brunner: Deutsch. Ztschr. f. Chir., 1903, 69.

of making a gastro-enterostomy arises. In the group under discussion the added ten minutes would not appreciably alter the final outcome.

2. It spreads infection to uninvolved portions of the general peritoneal cavity and into the lesser peritoneal sac. This objection is theoretical. In actual practice it is found that this rarely if ever occurs.

3. Gastro-enterostomy is not necessary because, in the first place, it does not always cure the underlying condition; and, in the second place, patients recover from the ulcer without it. The same objection could very properly be made to the procedure when applied as a curative measure for non-perforated ulcers, but, nevertheless, our statistics show that the best results are obtained with this method of treatment. Our studies further go to show that many of the so-called recurrences after operation for ulcer of the stomach or duodenum are due to other causes than the original ulceration.

4. The performance of a gastro-enterostomy at the primary operation adds to the mortality. Of those in our series, nine died; of these, three had had a gastro-enterostomy made at the primary operation. Of these three, one died of shock, one of pneumonia on the seventh day, and the third died on the thirty-third day from perforation of a coexisting ulcer. Another of the fatal cases, the one which had been treated primarily by packing, might have been saved if an immediate gastro-enterostomy had been made.

Taking the cases all in all, we found:

Of 8 patients treated by simple closure, 5 died; mortality = 62 per cent.

Of 10 patients treated by closure and immediate gastro-enterostomy, 3 died; mortality = 30 per cent.

Of 1 patient treated by tamponade, 1 died.

For the sake of controlling these percentages, they are also compared with those obtained by tabulating all of the patients operated upon in the first twelve hours after perforation. There were two patients whose perforation was treated by closure alone; both of these died. There were eight patients in whom, in addition to the closure, a gastro-enterostomy was made; two of these died.

In any individual case the question of adding gastro-enterostomy immediately must be decided at the moment of operation by the findings in the abdomen and by the general condition of the patient. Excluding the moribund cases, we believe that gastro-enterostomy is a most valuable procedure, not only as a help in securing the closure of the perforation, but also as a measure directed towards the underlying condition.



## PERFORATED ULCER OF THE STOMACH

*Jejunostomy.*—In a few patients jejunostomy will be indicated. When the ulcer which has perforated is high up near the cardia in an inaccessible location, or in those conceivable cases when it is impossible to find the perforation, or the condition of the patient does not permit an extended search, the indication is to exclude and put at rest the entire stomach and duodenum, and this is best done by jejunostomy and jejunal feeding. Cases are also met in which large perforating ulcers are found on or near the greater curvature, in the general region in which it is proper to make a gastro-enteric anastomosis, and in which the presence of extensive adhesions precludes the possibility of making a gastro-enterostomy. In such cases the condition of the patient and the local conditions prevent the excision of the ulcer area. In these cases, too, jejunostomy is indicated, and it practically becomes a matter of necessity.

Excision of the ulcer-bearing area in the presence of an acute perforation is a very dangerous procedure and is rarely, if ever, called for. It would find its chief indication in the acute perforations of carcinomatous ulcers.

## A REPORT OF NINE CONSECUTIVE OPERATIONS FOR PERFORATED GASTRIC AND DUODENAL ULCERS

BY JOHN F. SHEA, M.D.

OF BRIDGEPORT, CONN.

ASSISTANT SURGEON, BRIDGEPORT HOSPITAL

THE series of cases here reported was operated upon by Dr. Philip W. Bill and the writer, at The Bridgeport Hospital, between February, 1915, and March, 1916. All of the cases recovered, and I have accurate information from 7 cases as to their condition since operation.

For convenience of study, we have classified our cases into three divisions, acute, subacute and chronic. Seven of our cases were acute, in that the perforation occurred suddenly with a flooding of the peritoneal cavity with gastric contents. One was subacute, in that the perforation occurred suddenly, but the stomach being empty at the time, the symptoms were less intense, for the patient walked many miles after the development of symptoms, and at operation the opening was found to be partly occluded by plastic adhesions. The chronic case showed very few symptoms suggestive of perforations, and at operation a subphrenic abscess was found.

*Sex.*—All of our cases occurred in males, the youngest being nineteen years of age, and the oldest fifty-six years. In each case the *perforation* was single, but that does not mean there were no other ulcers present.

*Situation.*—In 5 cases the ulcer was situated on the anterior surface of the stomach, in 3 on the first portion of the duodenum, and in 1 on the posterior surface of the stomach.

It was observed that the perforation occurred within one inch of either side of the pyloric valve in every case.

The explanation of the decided frequency of perforations situated on the anterior surface lies in the added liability of this surface to trauma, its greater mobility, and the fact that protective adhesions are less easily formed.

*Diagnosis.*—When seen early, the diagnosis is easy. In 8 cases we were able to make a positive diagnosis before operation.

The most pronounced and characteristic symptom was pain in the abdomen. It differs from the pain of appendicitis, in that it is sudden, violent and continuous. In appendicitis the pain gradually increases in

## PERFORATED GASTRIC AND DUODENAL ULCERS

severity, and is worse at the end of an hour than it was at the beginning. The abdomen was flat, retracted and the rigidity board-like. The facial expression showed great distress, and the respirations were rapid and shallow.

In 5 cases the patient vomited, but this greatly increased rather than lessened the distress. Six patients gave a history of gastric disturbance, 3 gave no history of gastric trouble whatever.

In 4 cases we were able to demonstrate perfectly Claybrook's sign, namely, the heart and pulmonary sounds were transmitted to the abdomen, and there heard plainly.

*Operative Procedure.*—All of our cases were given ether. We have found it advantageous to give a preliminary injection of atropine, gr.  $\frac{1}{160}$ .

On opening the peritoneal cavity, in 6 cases, the preliminary diagnosis was confirmed by an escape of gas, or foul-smelling, yellowish fluid. When the perforation was found the opening was cauterized with the actual cautery, a purse-string inserted, which, when drawn tight, readily closed the opening.

In all cases drainage was provided. When there was considerable escape of fluid, the pelvis, as well as the local site of perforation, was drained.

Contrary to the procedure of many operators, we have not attempted the performance of immediate gastro-enterostomy, because, in our opinion, the added shock would prove detrimental in many cases, and also because we feel that many cases of gastric ulcer recover after perforation. It is noteworthy that the majority of our patients have remained free from subsequent gastric disturbance after treatment.

For the first twenty-four hours saline or tap water, one pint every three hours, is administered. On the second day, broths and water are given by mouth. Solids are gradually added, and by the seventh day the patient is receiving regular hospital diet.

Drains are removed as soon as possible. At the end of two weeks the patient is allowed to sit up, and is discharged two days later.

A brief résumé of the cases is as follows:

CASE I.—Mr. M. C., aged forty years. History of gastric disturbance for past five years. Seized very suddenly one morning with severe pains in abdomen. Diagnosis of ruptured ulcer made. Immediate operation. Perforated ulcer on anterior surface of stomach found; closed by purse-string suture; drainage over site of perforation; left hospital sixteen days later. Three months later patient had a return of gastric disturbance; X-ray showed an ulcer of duodenum. Posterior gastro-enterostomy was performed.

One year after patient reports he is feeling exceptionally well and has gained thirty pounds in weight.

CASE II.—Mr. J. Q., aged thirty-six years. No previous history of gastric disturbance. While eating his supper he was seized with severe cramps in epigastrium; a ruptured ulcer was diagnosed. Operation revealed perforating duodenal ulcer that was closed in the manner described. Discharged fifteen days after operation. A communication nine months afterward reports freedom from any gastric disturbance, and a slight gain in weight.

CASE III.—Mr. I. B., aged forty-nine years. History of gastric distress dating back two years. Seized suddenly after eating with terrific abdominal pain. House surgeon on his admission diagnosed ruptured gastric ulcer. Operation showed perforated ulcer on anterior surface of stomach; closed by purse-string suture. Made an uneventful recovery. Since operation he has remained free from any stomach disturbance.

CASE IV.—Mr. W. J., aged twenty-seven years. No history of any previous gastric complaint. Was transferred from medical to surgical service for operation for a supposed gall-bladder condition. A subphrenic abscess was found containing a *real* orange seed. On the posterior surface of stomach there was a thickening and numerous adhesions, leading us to conclude that perforation occurred here several days before operation. We have not heard from the patient since he left the hospital.

CASE V.—Mr. Z., aged eighteen years. No previous gastric disturbance. While on a long walk he was seized with a dull pain in abdomen, not severe enough to compel him to give up. Increasing in intensity he sought hospital treatment twelve hours after the pain began. A ruptured gastric ulcer or high appendix was the pre-operative diagnosis. Perforated ulcer on anterior surface of stomach was found. Fourteen days afterwards patient left hospital in good condition. No report as to his condition since leaving hospital is at hand.

CASE VI.—Mr. O. F., aged fifty-six years. History of gastric distress extending over a period of nine months. While at work was taken violently ill with pain in abdomen; removed to hospital at once; diagnosis of ruptured ulcer made. At operation opening was found on anterior surface. Patient made a speedy recovery, leaving the hospital twelve days after operation. A recent communication states that he is free from any gastric disturbance, and is steadily gaining in weight.

CASE VII.—Mr. P. B., aged forty-two years. No previous history of any gastric trouble whatever. While on a drinking debauch was taken ill with severe abdominal pains. On admission to hospital, a diagnosis of ruptured ulcer was made. At opera-

## PERFORATED GASTRIC AND DUODENAL ULCERS

tion a ruptured duodenal ulcer was found, which was closed in the manner described. Patient left the hospital well three weeks later. Two months after operation finds him at work, free from distress and gaining in weight.

CASE VIII.—Mr. G. L., aged twenty-eight years. For past three months he has complained of distress after eating. While working at his bench, he was seized with abdominal pains, so severe that when the ambulance arrived he was in shock. A diagnosis of ruptured ulcer was made, and confirmed by operation, the site of perforation being the duodenum. Owing to the development of pelvic peritonitis his recovery was protracted. A recent communication shows that he has gained twenty pounds in weight and has remained free from any stomach distress.

CASE IX.—Mr. J. G., aged forty-three years. Long history of gastric disturbance after eating. After a hearty meal was seized with pain in abdomen, so severe that he immediately sought hospital treatment. Perforated gastric ulcer was diagnosed. Operation showed the anterior surface of stomach to be the site of perforation. His recovery was rapid and uneventful. Word from his physician states him to be in better health than he has been for years, and free from the distress he so long complained of.



## RUPTURE OF THE COMMON BILE-DUCT ASSOCIATED WITH SUBPHRENIC ABSCESS

BY HERMON C. BUMPUS, JR., M.D.

OF ROCHESTER, MINN.

FELLOW, MAYO CLINIC

In a thorough review of the literature on ruptures of the common bile-duct, I was able to bring to light but 7 cases beside the case reported herein.

JANEWAY<sup>1</sup> in 1887 described a case which came to necropsy. A stone was found obstructing the common duct, causing suppuration, dilatation and perforation of all three ducts. The pyloric end of the stomach, duodenum and transverse colon were all adherent to the under surface of the liver. Upon removal of the liver a subdiaphragmatic abscess was discovered. The patient had given a history of a gall-stone colic of fourteen years' duration, with accompanying jaundice and the passing of calculi on several occasions. The terminal illness, a typical gall-stone attack, began one week before death. A very sharp abdominal pain occurred forty-eight hours before death, probably at the time of perforation.

MCWILLIAMS<sup>2</sup> collected and reviewed 114 cases of perforation of the biliary system, of which four were perforations of the common duct. One of them (Kehr's case) was that of a woman aged fifty-one years, who had had symptoms for four days, accompanied by jaundice. A cholecystectomy was done but the patient died. Calculi in both the common and hepatic ducts and perforation of the common duct were found at necropsy. The second case, reported by Riedel, was that of a man aged fifty-six years, with symptoms of three days' duration. A cholecystostomy was done, but the patient did not recover. Necropsy revealed a calculus in the common duct with accompanying perforation. The third case was reported by Routier and was that of a woman aged fifty-six years, with symptoms of only one day's duration. Operation revealed free bile and a perforation of the common duct. The gall-bladder and peritoneal cavity were drained and the woman recovered. At a second operation (cholecystectomy) multiple stones in the gall-bladder and ducts were found. The fourth of this group was Neupert's case; a woman aged forty-three years, with symptoms of fourteen hours' duration, with jaundice. A rupture at the juncture of the cystic and common duct and an impacted stone in the common duct were found at operation (cholecystectomy). The patient made a complete recovery.

CAMPBELL-HORSFALL<sup>3</sup> has reported a case in detail. His patient, a woman aged forty-five years, suffered with dyspepsia and spasmodic epigastric pain for years. Following one of these attacks of unmistakable gall-stone colic, she was seized with intense pain in the upper abdomen and chest. When first seen she was in a state of complete collapse. Operation was performed the following day. On opening through a right rectus incision, bile-stained fluid and pus welled up. The gall-bladder was shrunken and the fluid could be traced to the common duct. A rubber drain was carried down to the common duct and a

## RUPTURE OF THE COMMON BILE-DUCT

cigarette drain placed in the right kidney-pouch. The pelvis was also drained through a stab-wound. Two weeks later an accumulation of biliary matter was drained through a second stab-wound in the left flank. The patient made an uneventful recovery. Campbell-Horsfall feels that this case is of interest as demonstrating the urgency and success of early operation. He cites the four preceding cases and points out that in those reported by Riedel and Routier, in which operative procedures were instituted early, recovery resulted; the other two, in which operative procedures were delayed, ended fatally.

LAPENTA<sup>\*</sup> reports one case. A woman, aged sixty-nine years, was seized with excruciating epigastric pain followed by vomiting and coma. There was no history of previous gall-stone attacks. At operation the following day the gall-bladder was not distended. The lesser peritoneal cavity contained bile and bloody serum. There was a perforation 8 mm. in length in the common duct just below the entrance of the cystic duct from which a calculus was protruding. This and several smaller stones were extracted, a cholecystostomy being done. A cigarette drain was placed to the point of rupture. Recovery was uneventful. Lapenta lays great emphasis on the coma, believing it to be diagnostic of rupture of the common bile-duct. It is of interest in this connection to note that Campbell-Horsfall reports his patient as unconscious when first seen.

MEISSNER<sup>\*</sup> has reported 12 cases but all were traumatic in origin and, therefore, will not be considered in this paper.

The history of our own case is as follows:

Mrs. A. P., a married woman aged forty-four years, came to the Mayo Clinic January 24, 1916. Her family history was negative and the only sicknesses she could recall, save those directly connected with her present trouble, were grippe and tonsillitis, fourteen years before, and an occasional attack of rheumatism. She had been pregnant six times. Four children were living, the oldest twenty-five, the youngest seven. Two were born before full term, and lived but a few weeks. During her first pregnancy, twenty-four years before, she had several attacks of severe cramp-like pain below the right costal margin. Two years later, during her second pregnancy, the severity and frequency of these attacks increased and on several occasions were accompanied by jaundice requiring two to three weeks to clear. Six months after this pregnancy she had a very severe attack with extremely deep jaundice. During her third and fourth pregnancies she had frequent recurrences of this trouble, and during her fifth pregnancy she had as many as nine to ten attacks of gall-stone colic. Since then, *i.e.*, for the past fifteen years, although she has had frequent and varied attacks, they have never been accompanied by jaundice. On several occasions she has passed calculi by bowel. Three months previous to her present trouble she had an attack lasting twenty-four hours, during which she vomited a great deal of bile-stained material. On December 25, 1915, about 7 o'clock in the evening, the patient experienced con-

siderable upper abdominal discomfort. This became progressively worse, and at 10 o'clock the pain was so severe that she took a quarter of a grain of morphia for relief. At first, as in all the previous attacks, the pain was felt along the right costal margin radiating through to the right shoulder-blade. At six o'clock of the morning of the second day, she was seized suddenly with a sharp pain in the right lower quadrant, so severe that in spite of the fact that she had taken another quarter of a grain of morphia, it forced her to cry out with every breath. During the night she had three bowel movements. The next morning, however, the family physician could not get any results, either gas or fecal, with enema. The low abdominal pain continued for two and one-half days. One week after the onset of the attack a severe burning pain developed in the base of the right chest and at the same time a swelling slowly appeared in the right lower quadrant. This continued to grow in size and her condition became worse until January 24, when she was examined in the Mayo Clinic.

The patient was emaciated and weak, requiring assistance to get about. A slight yellow tinge was noted in the sclera. Pulse 120; temperature 101°. She had a short irritating cough and was unable to take a deep breath because of pain. The chest showed dulness and absence of breath sounds at the right base. The abdomen was very tender and rigid over the region of the gall-bladder. A large mass could be palpated below the right costal margin, extending along the nipple line to the crest of the ilium. The urine was acid and contained a trace of albumen; specific gravity 1017. White blood-cells, 17,600. Radiologist's report: Increased density in the lower right chest to the level of third rib in front. Diaphragm appeared to be above the mass.

*Operation.*—On January 26, a diagnosis of subdiaphragmatic abscess and acute inflammation of the gall-bladder having been made, an operation was performed under local anæsthesia (Judd). Temperature 100.4°; pulse 120. Through a stab incision in the right flank, a blunt dissection was made forward outside the peritoneum to the point of adhesion between the abscess-mass and the abdominal wall. Through an opening here two to three quarts of turbid, greenish yellow, somewhat purulent, odorless fluid and numerous calculi escaped under considerable pressure. A large rubber-tube drain was inserted and the patient placed in bed. The abscess cavity drained biliary detritus for seven days; the temperature and pulse returned to normal. Although still quite weak, the patient was up on the tenth day and gained rapidly until the night of the thirteenth day, when she was seized with an attack of typical gall-stone colic. The pain, which was

## RUPTURE OF THE COMMON BILE-DUCT

very severe, began below the right costal margin, radiated through to the back and was accompanied by nausea and vomiting. Her condition showing no improvement the next day, February 10, a second operation was performed, through a modified Bevan incision. There were many adhesions and the tissues were all very much indurated. The gall-bladder was tense, cystic and shrunken; the mucous membrane, though almost completely destroyed, still retained clear cystic fluid with numerous stones, but no bile. Some of the stones were impacted in the cystic duct, completely obstructing it. The abscess which had been drained two weeks previously was found to be subphrenic, there being a large pocket in the right anterior subphrenic space. With the operating field clear of old clots and adhesions, bile was found leaking from a point high on the common duct, just at the juncture with the cystic duct. There were also two stones obstructing the common duct, one stone presenting at the perforation.

Cholecystectomy and choledochotomy were done and a Robson hepatic drain was placed in the common duct. The subphrenic abscess was well sponged out and packed with three strips of iodoform gauze and a split tube. A second split tube and gauze were placed so as to drain the stump of the cystic duct. The wound was closed in the usual manner, and before the patient was taken from the table bile was flowing freely from the Robson tube.

The patient's convalescence was uneventful, save during the third and fourth days, when nausea and vomiting were very annoying. Gastric lavage every six hours overcame this complication, although for several hours the pulse was 130. On the sixth day, while the gauze was being shortened, the Robson tube came out. All of the gauze was removed on the eighth day, and the rubber tubes on the thirteenth and fourteenth days, respectively. At this time the patient was out of bed. Three days later, when she left the hospital, all bile drainage had ceased, although a small sinus persisted.

Moynihan<sup>6</sup> states that the cardinal symptoms of rupture of the common bile-duct are: Jaundice, absence of bile in the stool, gradual distention of the abdomen and wasting. The jaundice, he points out, is never intense, but is rather a yellow tinge in the skin or a slight yellowing of the sclera, as in the case reported here. This is because the bile is only slightly absorbed by the peritoneum after the first inflammatory exudate is set up and because there is no retention of it in the liver. For the same reason the bile in the urine is slight. The stools are always clay-colored, for all the bile escapes from the rupture,

none entering the intestine. A constant feature is the gradual distention of the abdomen. This may be general, due to the flow of the bile over the entire abdominal cavity, but more commonly is confined to one part as a local swelling, generally in the right hypochondrium, as in our case. A rapid loss of flesh is always noted, and emaciation and weakness may be extreme; our patient lost 20 pounds in a little over two weeks. The typical pathologic condition is an inflammatory softening and distention of the walls due to the obstruction of the duct with a final ulceration and giving way of the tissues. The rupture may occur into the general peritoneal cavity, but by the aid of protective adhesions a localized abscess is generally formed.

Riedel<sup>7</sup> reports two cases in which a localized abscess resulting from rupture of the cystic duct had involved and perforated the common duct.

The foregoing 8 cases follow closely the symptoms and pathology given by Moynihan. They also demonstrate the benefit to be derived from early operation, preferably in two stages. The first stage, which consists of drainage, enables the patient to undergo the second and more extensive operation with far less risk.

#### REFERENCES

- <sup>1</sup>Janeway, E. G.: New York Med. Jour., 1877, xxvi, 831. Quoted by Moynihan, *l. c.*
- <sup>2</sup>McWilliams, C. A.: Acute Spontaneous Perforation of the Biliary System into the Free Peritoneal Cavity. ANN. SURG., 1912, lv, 235-263.
- <sup>3</sup>Campbell-Horsfall, C.: A Case of Perforated Common Bile-Duct Followed by Subphrenic Abscess, Operation and Recovery. Brit. Med. Jour., 1913, ii, 118-119.
- <sup>4</sup>Lapenta, V. A.: Perforation at the Juncture of Cystic and Common Duct. Surg., Gynec. and Obst., 1915, xx, 552-553.
- <sup>5</sup>Meissner: Die Zerreibungen der Gallenausführungsgänge durch stumpfe Gewalt. Beitr. z. klin. Chir., 1907, liv, 204-221.
- <sup>6</sup>Moynihan, B. G. A.: Remarks Upon the Surgery of the Common Bile-duct. Lancet, 1906, i, 147-154.
- <sup>7</sup>Riedel: Partielle oder totale Zerstörung von Ductus cysticus und choledochus durch Stein. München. med. Wchnschr., 1912, lix, 2403-2406.



## ANOMALIES OF THE GALL-BLADDER AND BILE-PASSAGES

WITH THE REPORT OF A DOUBLE GALL-BLADDER AND A FLOATING GALL-BLADDER

By AUGUST SCHACHNER, M.D.

OF LOUISVILLE, KENTUCKY

ABDOMINAL surgeons of to-day, and more especially of the future, will hardly be content with a general knowledge of the anatomy of the abdominal viscera.

Refinements in operative and diagnostic technic will demand a detailed knowledge of the anomalies in whole or in part of abdominal organs.

In view of this forecast, it behooves us to investigate and more fully report the various anomalies as they present themselves.

To this end there should be a closer coöperation between the operating room, the anatomic laboratory, and the pathologic laboratory, in order that definite data may at an early period be recorded, indicating the possible frequency of the various anomalies.

This paper is based upon an inquiry into the literature, present and past, and an exchange of communications with a number of surgeons and hospitals. I wish to publicly record my thanks to the various surgeons and hospitals for their answers to my communications.

The inquiry developed the fact that practically no additional material was acquired through these communications. That this result is misleading, there can be but slight doubt, and the fact that one operator (Kehr) who follows somewhat different lines and with different results, so far as anomalies are concerned, strongly supports this view.

The array of anomalies presented by Kehr stands alone both as to number and variety. This exceptional collection is partially explained through Kehr's statement, that a more thorough search should be undertaken at the time of operation and that the operative procedure should be carried out through a larger incision, or at least an incision yielding a more accurate survey of the field of activity. He condemns what he calls "the button-hole incision," so commonly employed in American surgery.

We feel inclined to add that the result of the correspondence left us convinced that inadequate incisions do defeat an accurate survey, and that many valuable findings have been lost in the past through the absence of proper search and a suitable system of recording the anomalies that were revealed.

It may be well to say that this paper is restricted to congenital anomalies, and not to malformations resulting from pathological processes. Further, many reports encountered, in examining the literature, were rejected because they were so obviously deficient in definition, or so apparently due to pathological processes, that their value as reports was hardly justified. No effort was made to study the vascular anomalies attending the blood supply of the liver, gall-bladder, or bile passages.

In many instances it was shown in the cases reported, that anomalies in this region follow the rule of anomalies elsewhere in the human subject, namely, in not occurring singly, *i.e.*, an anomaly of the gall-bladder may have an attending anomaly of the ducts or the blood supply, or some other part of the hepatic system. This is especially noticeable in the properly conducted post-mortem examinations, where the investigations could be carried out in detail, a privilege often denied during a surgical operation.

When the development during the embryological period is disturbed, this disturbance is usually not of an isolated nature.

## SYNOPSIS

## ANOMALIES OF GALL-BLADDER

Anomalies relating to gall-bladder cavity .....	Double gall-bladder.
	Bilobed gall-bladder.
	Diverticulum of gall-bladder.
Anomalies relating to location of gall-bladder .....	Intrahepatic gall-bladder.
	Left-sided gall-bladder.
	Transposition of viscera.
	Floating gall-bladder.
Individual anomalies .....	Absence of gall-bladder.
	Hour-glass gall-bladder.

## ANOMALIES OF BILE PASSAGES

- (1) Double cystic duct.
- (2) Anomalies of hepatic ducts.
- (3) Absence of common duct.
- (4) Anomalies of common duct.

*Double Gall-bladder.*—To come under the above classification, each gall-bladder should have its independent cystic duct, thus differentiating it from a bifid gall-bladder in which the cavities are distinctly separate, but communicate with the common duct through a single cystic duct.

CASE I.—Dr. Purser exhibited a liver with two gall-bladders. It was taken from a girl aged eleven, who had lately died of malignant scarlatina in Sir Patrick Dunn's Hospital. At the postmortem, besides the ordinary changes caused by the disease, two separate gall-bladders were found, each of which had a distinct cystic duct; and these opened into the bile duct, the one at some distance from the other. There were no marked anomalies in the liver except that the common hepatic duct, instead of dividing into two branches when coming into the

## ANOMALIES OF THE GALL-BLADDER AND BILE-PASSAGES

liver, divided into three, one to the left, another to the right, and a third running into the posterior part of the liver. These ducts did not communicate with one another, but were distinct in their whole course.

CASE II.—Dr. Purser (*British Medical Journal*, 1886, vol. ii, p. 1102) was indebted to Dr. Foot for a case recorded in the Philosophical Transactions. The subject was a lady aged thirty-one, who for some time before her death had suffered from loss of appetite, vomiting and pain. At the post-mortem examination, her lungs were found to be in a state of commencing phthisis. The spleen was smaller than usual, but the liver was so large that it occupied the left hypochondrium as well as the right; there were strong adhesions on both sides; there were two gall-bladders, both distended with bile, one in the right and the other in the left lobe of the liver.

CASE III.—The existence of the double gall-bladder was not recognized until the peritoneal covering was removed. Then it was apparent that the gall-bladder was double from the fundus to the neck.

There were two cystic ducts, the one communicated with the hepatic duct. The second subdivided into two subdivisions. The course of one subdivision was unavoidably lost, and that of the other subdivision communicated with the common duct. The points in the case are double gall-bladder with a single neck and two cystic ducts. (Cruveilhier, E.: *Bul. Soc. Anat. de Paris*, 1860, xxxv, p. 66.)

CASE IV.—On opening the abdomen through the right rectus muscle, I found a distended gall-bladder which I could not empty. On tracing the cystic duct downward to discover the cause of the obstruction, I came upon a firm nodule, which I took at first to be a calculus. As it was apparently firmly impacted, I cut through the peritoneum covering the duct and discovered that the supposed calculus was a thickening in its wall about three-quarters of an inch from its junction with the common bile duct. I ligatured and divided the duct and then found that I could not strip up the gall-bladder in the usual way, and the duct tore just above the nodule in the attempt. On further dissection I found another duct which I ligatured and divided, covering the stump with peritoneum, and closed the belly.

On examining the specimen (now in the Museum of the Royal College of Surgeons of England, No. 561.31), the ducts were at once evident and closer examinations revealed another sack above and completely concealed by the distended lower one. On section two complete gall-bladders were evident, joined only along a narrow portion of their circumference. The larger one contained thick bile-stained mucus, the smaller thin bile. On examining the portion of the cystic duct belonging to the larger gall-bladder, I found it patent at its common duct end; at the site of the nodule, its lumen was a little increased in size and ulcerated, as if from the lodgement of a calculus. Above this it appeared to be obliterated. (Sherren: *ANNALS OF SURGERY*, vol. liv, p. 204.)

CASE V.—Author's case of double gall-bladder. Miss G., aged fifty-two, of Simpsonville, Ky., was referred to me through the kindness of her physician, Dr. Joseph Perrin, of the same place. She had been a sufferer from gall-stone colic and dyspepsia for the last 15 or 20 years.

*Operation.*—At the Jewish Hospital, March, 1914. Incision right semilunar line. On exposing the gall-bladder, a raphe was

evident, passing from the fundus to the neck and dividing the gall-bladder surface into two unequal halves. A mesentery existed, which also passed from the fundus to the neck. The inner blade of this mesentery became lost in the peritoneal covering of the duodenum; the outer blade was reflected over the hepatic flexure of the colon with which it became merged. The mesentery, which measured about 6 cm. from its central to peripheral borders, was freed from the gall-bladder, permitting of easy access to the same. The unequal division of the surface was at first thought to be the result of former inflammatory attacks. On opening the gall-bladder, the error of this conclusion became evident. The gall-bladder was plainly a double one, with stones in each gall-bladder. After draining these and removing the stones, a careful examination was conducted to more fully determine the exact arrangement. The result of this was a double gall-bladder, each with its independent neck and, so far as we were able to determine, two cystic ducts. Both gall-bladders were drained, the patient making a satisfactory recovery, which has continued.

*Bilobed Gall-bladder.*—A gall-bladder, the cavity of which consists of two lobes communicating with the common duct through a single cystic duct.

CASE I.—The gall-bladder was bilobed. The greater lobe being discolored, and almost gangrenous at its lower portion. This lobe contained one calculus. The other lobe seemed to be normal. There was only one cystic duct draining both lobes. It was patulous. (Deaver and Ashhurst: vol. ii, p. 42.)

*Diverticulum of Gall-bladder.*—A gall-bladder consisting of one large cavity and one or more smaller cavities or recesses communicating with the larger or true gall-bladder.

CASE I.—The gall-bladder was distended and full of calculi of various sizes. The neck of the gall-bladder just above the cystic duct was pouched in such a way as to form a sack which pressed upon the common duct and caused obstructive jaundice. (Deaver and Ashhurst: vol. ii, p. 42.)

CASE II.—Kehr (vol. i, p. 127) reports a diverticulum of gall-bladder filled with stones and in the same case the common duct divided just beyond the entrance of the cystic duct into two divisions.

CASE III.—Kehr (vol. ii, p. 291) reports another case of diverticulum together with unusual vascular anomalies and pathology.

AUTHOR'S COMMENT.—The operation lasted one hour and it is remarkable that so much vascular anomaly and pathology could be revealed and cared for in one hour, even though the incision was a free one.

CASE IV.—Macroscopic appearance: The gall-bladder on its inner surface, near the fundus, presented an enlargement of an oval shape. The maximum measurement in length was 15 mm. The maximum measurement in breadth was 8 mm. The highest point above the surrounding surface was 3 mm. An opening into this 1 mm. in width was present.

## ANOMALIES OF THE GALL-BLADDER AND BILE-PASSAGES

CASE V.—Macroscopic appearance: The wall of the gall-bladder measured 6 mm. in thickness. This thickness was made up of distinct lamellæ, much like in structure to that of a thrombus. The peritoneal covering is also thickened. On the inner surface of the gall-bladder, a wedge-shaped opening 8 mm. in length was observed. This cavity was lined throughout by mucous membrane.

CASE VI.—Macroscopic appearance: In the fundus of the gall-bladder there was a funnel-shaped excavation. The surrounding edges of this cavity were 3 mm. in thickness and 4 mm. in width. In this case the microscopic examination proved this to be adenomatous in character. (Herman Weltz, Kiel: Ueber Divertikel Der Gallenblase.

CASE VII.—Diverticulum of gall-bladder occurring in a child one year of age. The compartment occurred near the fundus. The dividing septum occupied a transverse position and measured 2 mm. in thickness. The septum was 8 mm. in distance from the fundus. (Dévé: Bul. Soc. Anat., Paris, 1903.)

### ANOMALIES RELATING TO LOCATION OF GALL-BLADDER

*Intrahepatic Gall-bladder.*—A gall-bladder partly or entirely imbedded in liver substance as opposed to merely occupying the classical gall-bladder depression on the under surface of the liver.

All degrees of this condition may occur from a small bridge of liver tissue passing across from the quadrate to the right lobe to complete submersion of the gall-bladder so that no trace of it is discernible from the outside. The latter condition is the only one which would be confused with a misplaced or absent gall-bladder, but in this degree it is extremely rare. According to Dévé the gall-bladder is only truly intrahepatic in infancy. Later on in life the covering of the liver tissue atrophies on the under surface and the gall-bladder becomes exposed. There is a case recorded by Lemon where the fundus of the gall-bladder alone projected and in which gall-stones were present (Walton).

Dévé speaks of the arrangement in reptiles, in which the gall-bladder is almost completely buried within the liver substance. He expresses surprise that the intrahepatic arrangement has not attracted more attention. The existence of intrahepatic gall-bladder was marked through a difference in color, the yellowish or greenish color of the gall-bladder being in striking contrast to the reddish-brown color of the liver substance; as a further guide, the topographic elevations of the overlying liver substance. Dévé, in a study of 130 livers of infants, discovered 11 instances of intrahepatic gall-bladder, 3 were typical and in 8 the fundus alone was more or less imbedded; no intrahepatic condition was noticed in adults.

To the case of Lemon may be added 4 cases observed by Kehr (vol. i, p. 116), making a total of 16 intrahepatic gall-bladders.

*Left-sided Gall-bladder.*—One occupying a position to the left of the falciform ligament in a normally placed liver.

CASE I.—The present specimen I wish to report was obtained from an anatomical subject, a full-time female foetus, in the Anatomical School of the London



Hospital. The history of the cause of death was naturally difficult to obtain, but as far as could be ascertained, this took place in prolonged labor. The gall-bladder was situated on the left lobe, but is normal in shape and attachment. The neck of the bladder is directed towards the right instead of towards the left side, and there is a well-marked Hartman's pouch just before the origin of the cystic duct. The fundus reaches to but does not project beyond the free margin of the liver. The gall-bladder lies well to the left of the umbilical vein, but the area between it and the structures which presumably should be called the quadrate lobe, is small, so that in life the gall-bladder lay close to the falciform ligament and was, when viewed from the right side, wholly covered by this structure. If, therefore, symptoms of disease of the gall-bladder or some neighboring structure had arisen which necessitated exploration through the usual incision, traversing the right rectus, the gall-bladder would at operation have been invisible, and even if the liver had been pulled well over to the right, it would have remained hidden beneath the falciform ligament which would have been stretched across it.

The difficulty which would arise at operation with such a condition would be to discover the gall-bladder, and it would be necessary, if the under surface of the right lobe were free from adhesions and visible, to distinguish it from the three following conditions; extreme fibrosis and atrophy of the gall-bladder after inflammation, complete congenital absence of the gall-bladder, and an intrahepatic gall-bladder. (Walton: *Lancet*, 1912, p. 925.)

CASE II.—A case of left-sided gall-bladder occurred in a child ten years of age, at the Hospital Trousseau, in which there occurred an abnormal arrangement of the caudate and quadrate lobe, together with a gall-bladder attached to the left lobe of the liver.

CASE III.—The gall-bladder was not only left-sided, but was situated obliquely in its relationship to the liver. This occurred in an adult.

CASE IV.—Another case likewise in an adult, in which the neck of the gall-bladder was attached to the left lobe of the liver but the fundus and body detached, was described as a case of ectopia of the gall-bladder. (Dévè *Bul. Soc. Anat.*, Paris, 1903.)

CASE V.—Hochstetter refers to a single case of left-sided gall-bladder mentioned by Huschke. Huschke's case was that of an eighteen-month-old child, in which the gall-bladder, otherwise normal, was situated to the left side and practically covered by the ligamentum teres.

CASE VI.—Left-sided gall-bladder and transposition of the umbilical vein to the right. This case was that of an adult. There was an absence of the lobus quadratus and the presence of a left-sided gall-bladder. The gall-bladder was located to the left of the ligamentum teres, with a small area of liver substance between the gall-bladder and the ligaments. Circulatory anomalies were present in this case.

CASE VII.—Recently born infant. The gall-bladder located to the left of the ligamentum teres and an absence of the lobus quadratus. In addition, in this case, the left lobe exceeded in size the right lobe of the liver. In this, as in the former case, there was an anastomosis between the umbilical and portal vein.

CASE VIII.—Body of an adult in which the gall-bladder was located immediately to the left of the ligamentum teres. The venous arrangement was practically normal.

CASE IX.—Body of an adult. In this the right and left lobes were about an

## ANOMALIES OF THE GALL-BLADDER AND BILE-PASSAGES

equal size and the quadrate lobe was absent. The gall-bladder was located to the left of the ligamentum teres.

CASE X.—A child, eighteen months old. The quadrate lobe was absent and the gall-bladder was located immediately to the left of the ligamentum teres. (Hochstetter, Ferdinand: *Archiv f. Anatomie und Physiol.*, 1886, p. 369.)

CASES XI and XII are represented by two cases referred to by Kehr, vol. i, p. 119.

CASE XIII.—See Case II, Double Gall-bladder. In this the gall-bladders were widely separated, one occupying the right and the other the left lobe of the liver.

*Transposition of Viscera.*—In this condition the liver not only occupies the left instead of the right hypochondrium, but there is a reversal of the lobes, the left being larger than the right, and receives the gall-bladder.

Last, there is a dextro-position of the heart as well as reversal of duodenum and stomach, which becomes our most important diagnostic aid in verifying our suspicions regarding the visceral transposition and disturbances that might arise in a gall-bladder so situated.

CASE I.—A left rectus incision was made. The gall-bladder was readily accessible. Its walls were thickened, but free from adhesions. About 70 c.c. of greenish black bile was aspirated and the gall-bladder was incised. Four mulberry stones, the size of a pea, were removed. The ducts were freed. The gall-bladder was drained. The anomaly of transposition of the viscera was verified. The patient did not bear the anæsthesia well and a hasty closure was made. An uneventful recovery followed. (Horn: *Situs Viscerum Inversus with Gall-stones. ANNALS OF SURGERY*, vol. lxii, p. 425.)

Horn refers in his paper to cases by Beck, Fenger, Kehr, Hupp, and Bland Sutton, in which the reports definitely refer to the verifications of the condition through operation. There are two other cases in Horn's report, one by Billings, in which no mention is made of operative verification, and one from the Mayo Clinic, with desirable details lacking. If we accept the cases in Horn's paper, we have a report of 8 cases.

Kehr reports two cases of situs transversus (vol. i, pp. 121 and 122), and in the absence of definite information, assuming that one of the two cases has been mentioned by Horn, we have another case. Kehr further mentions the report of Benda (vol. i, p. 123), who has found two cases of situs transversus in 10,000 autopsies at the Urban Hospital in Berlin. This gives a total of 11 cases of situs transversus.

*Floating Gall-bladder.*—A gall-bladder with a distinct mesentery and usually attended with a wide range of mobility.

CASE I.—Gall-bladder found to be small and containing numerous calculi. The remains of pericholecystic inflammation were evident in numerous adhesions.

The gall-bladder was freely movable after the adhesions were liberated and had a distinct mesovesica which extended from near the fundus to the cystic duct. (Deaver and Ashhurst: vol. ii, p. 43.)

CASE II.—Kehr (vol. i, p. 182) reports one case of a gall-bladder with a well-developed mesentery.

CASE III.—Author's case of floating gall-bladder. Mrs. H., aged about forty-five years, living near Ellettsville, Ind., was seen through the kindness of Dr. W. W. Harris, of Ellettsville, Ind., in consultation with Dr. Allen Pierson, of Spencer, Ind., in the month of June, 1906. She had been suffering from digestive disturbances, with vague pains in the upper abdomen. On inspection and palpation, a movable mass, somewhat the shape and about the size of a normal kidney, could easily be mapped out through a rather thin abdominal wall. The range of motion was extensive enough to permit this mass to be pushed to either kidney region, but its downward excursion was more limited. The diagnosis lay between a floating kidney and intestinal neoplasm, and a distended gall-bladder. On opening the abdomen it proved to be the latter. The gall-bladder possessed a mesentery passing between the upper surface of the same and the under surface of the liver. The operation, which occurred in a farm house, was made through the smallest possible incision, that unfortunately did not permit a careful examination of the peritoneal arrangement. The gall-bladder was aspirated, removing about 250 c.c. of clear, glycerin-like fluid, and a stone that was impacted in the neck.

CASES IV, V, VI, VII and VIII.—Brewer, in the examination of 100 subjects in the Anatomical Laboratory of Columbia University, found 5 cases of gall-bladders with distinct mesenteries, allowing considerable movement. In 3 of these there was also an extension outward of the free border of the lesser omentum to the fundus and, in one instance, to a point one inch beyond the fundus, thus forming a double mesentery, the upper being attached to the under surface of the liver, the lower to the duodenum and transverse colon, and in the one instance, to the hepatic flexure of the colon. (Brewer: *Anatomy of Gall-bladder and Ducts*, ANNALS OF SURGERY, vol. xxix, p. 723.)

*Absence of Gall-bladder.*—Including only cases of a congenital absence or agenesis, as opposed to an absence of gall-bladder due to a destruction of the same through a pathologic process.

CASE I.—The case occurred in a rhachitic colored child, two years old, that had never walked unsupported and had presented no symptoms suggestive of any anatomic peculiarity referable to the biliary apparatus or to other structures.

At the postmortem the liver appeared of normal size and condition. It presented a whitish nodule at its anterior margin.

Histological examination of section from which shows the remains of hepatic parenchyma in part in a state of fatty degeneration, together with the hyperplasia of connective tissues, accumulations of round-cells, and in places homogeneous

## ANOMALIES OF THE GALL-BLADDER AND BILE-PASSAGES

loss of structure, changes that I take to be syphilitic origin. The section that I exhibit shows the presence of the hepatic portal and biliary vessels. No gall-bladder could, however, be found, either attached to or detached from the liver, or even contained within the structure of this organ, and as I show you, the usual fissure for the gall-bladder is wanting, and there is nothing suggestive of the previous presence of this viscus.

The case thus clearly resolves itself into one of agenesis of the gall-bladder. The absence of the gall-bladder is common in some animals, as, for instance, the elephant, the rhinoceros, the camel, the goat, the deer, and some species of fish, some birds, and some rodents.

CASE II.—In 1865, Sands (*New York Medical Journal*, June, 1865, vol. i, p. 222), before the New York Pathological Society, reported finding in the dissecting room in a tuberculous male subject, about twenty years old, a liver without a gall-bladder and without a fissure for its lodgement. The liver was small, weighing one and three-fourths pounds, and its quadrate lobe was wanting.

CASE III.—Tambault and Schachman (*Bulletin de la Société Anatom. de Paris*, 1882, lvii, Ann. 4e sér., tome vii, p. 499) have reported the case of a parietic dement, who after death presented, in addition to classic lesion of parietic dementia, a small liver with absence of the gall-bladder; the fossa for this viscus being replaced by a small fissure. There was no indication of a cystic duct. The hepatic ducts presented no abnormalities. During life there had been no symptoms suggestive of the absence of the gall-bladder. (A. A. Eschner: Congenital Absence of the Gall-bladder, *Med. News, Phil.*, 1894, lxiv.)

The same author reported a series of 12 cases, including his own, and from these 12 cases the first 3 above reported have been taken, the remaining 9 of Eschner's list being too doubtful to justify repetition. Eschner himself is uncertain regarding the majority of his cases as being cases of agenesis of the gall-bladder.

CASE IV.—This specimen was removed at the post-mortem examination of a man, aged forty-nine, who died from pulmonary tuberculosis. There was nothing of any interest in his previous history. The main point of interest about the specimen is that, in spite of the absence of the gall-bladder, the hepatic ducts are normal, and there is no dilation of the bile ducts. (Arthur Latham: Absence of Gall-bladder. *Journal of Anatomy and Physiology*, 1897-1898.)

CASE V.—According to Rolliston, a second one was shown by Thursfield, at a meeting of the Pathological Society in 1903. Both of these (one of these being Latham's) were carefully dissected, so there was no doubt that the condition was one of complete absence and not extreme fibrosis after inflammation.

CASE VI.—There is a third specimen in the London Hospital Museum, No. 1395 A, where also the condition is clear. In this case there is a deep furrow in the position which the gall-bladder should occupy, so that the quadrate lobe is quite distinct from the rest of the right lobe. (A. J. Walton: *Lancet*, 1912, p. 925.)

CASE VII.—The case was that of a child that died on the eighth day. The abnormally large right lobe over the left was apparent from the upper surface. On the under surface the absence of the gall-bladder and the lobus quadratus, as well as the unusually small left lobe, were notable. The sagittal fissure was converted into a canal through the presence of a bridge of liver substance. This canal was traversed by the umbilical veins. (Hochstetter, F., *Archiv f. Anatomie u. Physiologie*, 1886.)



Förster refers to the gall-bladder being absent in a number of cases and adds that in such cases the common duct is usually larger than customary. He also mentions the possible absence of the common and hepatic ducts, and in other cases the hepatic ducts remaining united and emptying separately into the duodenum, or one into the duodenum and the other into the stomach, and, further, the possible division of the common duct in which one-half communicates with the stomach and the other half with the large intestine. (Förster, August: *Die Missbildungen des Menschen*, Jena, 1865).

Weltz, without giving details, refers to cases of absence of gall-bladder reported by Wahlborn, A. G. Richter, Wiedeman, Amussat, and Buttner. (Weltz, G. H.: *Ueber Divertikel der Gallenblase*, Kiel, 1894.)

*Hour-glass Gall-bladder.*—A gall-bladder consisting of two cavities separated by a pervious isthmus. Adhering to the rule of recognizing only such anomalies that are of congenital origin, instead of anomalies dependent upon a pathologic process, the writer has been unable to find any instance of a true hour-glass gall-bladder. Several cases of hour-glass gall-bladder of an inflammatory origin have been recorded by Deaver and Ashhurst and Kehr, as follows:

Adhesions between the gall-bladder and stomach. These were ligated and cut and the gall-bladder was found to be hour-glass in shape, both pouches filled with calculi. The other reference by Deaver is as follows: Adhesions between liver and duodenum. Gall-bladder was hour-glass in shape, the two portions being united by a fibrous band. Distal portion, which was free from calculi, was removed. Proximal portion contained four stones. Cholecystostomy was performed. (Deaver: vol. i, p. 43.)

Kehr refers to several cases of hour-glass gall-bladder due to the presence of a former ulcer.

#### ANOMALIES OF BILE PASSAGES

*Double Cystic Duct.*—CASE I.—Dr. Dressmann reports a case of double cystic duct as follows:

The woman was forty-two years of age. For the last six or seven years she had abdominal pains, especially at the time of her menstruation. On examination a tumor the size of a fist, movable and occupying the left side above the level of the umbilicus. The uterus was anteflexed and had a small subserous myoma. An abdominal section was performed January 4, 1907. The left-sided movable tumor above referred to proved to be an enlarged and elongated gall-bladder containing numerous large stones. A cholecystectomy was performed. The bladder was separated from the liver, cystic artery ligated, and the cystic duct divided to permit an investigation of the common duct. After a division of the cystic duct, much to the surprise of the operator, a second cystic duct became apparent. On careful investigation it was proven that both ducts united just before their junction



## ANOMALIES OF THE GALL-BLADDER AND BILE-PASSAGES

with the common duct. These two ducts paralleled one another and opened independently in the gall-bladder, each opening being separated from the other through a space of 1 cm. (Dressmann: *Deutsche Zeitschrift für Chirurgie*, vol. xcii, 1908, p. 401.)

CASE II.—Kehr refers to two cases of double cystic duct reported by Ruge and Dressmann, the latter being the foregoing case (vol. i, p. 127).

*Anomaly of Hepatic Duct.*—CASE III.—The specimen was taken from the body of a man, aged forty-nine, who died in the Great Northern Hospital, under the care of Dr. Cholmeley.

The excretory apparatus of the liver is here so arranged that the whole of the bile must have passed through the gall-bladder on its way to the intestine. The gall-bladder itself is much smaller than usual. When laid open it measured two inches in length, and rather less in breadth. It would hold about two drachms of fluid. In its upper or attached wall, there are two openings, the larger one near the centre is the orifice of the principal hepatic duct, the smaller one nearer the fundus is the orifice of a cystohepatic duct. The large ducts of the left lobe pass across the longitudinal and transverse fissures where they become superficial, and join the principal duct of the right lobe shortly before it opens into the gall-bladder.

The cystic duct which appears to be the sole channel of communication between the liver and duodenum is, at its commencement, constricted so as to admit nothing larger than a probe, but immediately dilates considerably. The arrangement described in this case, which appears to be so abnormal in man, is the normal one among some of the lower animals. Thus Prof. Owens states that in certain fishes, wolf fish, *Erythrinus Lepidosiren*, the bile is conveyed to the gall-bladder by hepatocystic ducts, and thence by cystic duct to the duodenum. Again in certain reptiles *Siren Amphiuma* the hepatic ducts communicate with the cystic or the gall-bladder, and the bile is conveyed directly by the cystic duct to the beginning of the intestine. In *Mammalia*, on the other hand, as a rule, all ducts unite into one trunk, which in those having a gall-bladder joins the cystic duct to form the common duct.

*Malformation of the Gall-bladder and Hepatic Duct.*—H. H. Crooknell (Trans. Path. Soc. London, vol. xxii, p. 163.)

CASE IV.—See Case I, Double Gall-bladder. The hepatic duct divided into three divisions, right, left and posterior. These ducts did not communicate with one another, but remained distinct throughout their course.

*Accessory Hepatic Ducts.*—CASES V, VI and VII are represented by three cases reported by Kehr, which terminated blindly near the neck of the gall-bladder. Kehr further describes three possible anomalies of the hepatic duct and gall-bladder, one consisting of accessory hepatic duct, emptying directly into the gall-bladder, as it occurred in one of his cases. Second, where the right hepatic duct, singly or divided, empties into the gall-bladder, so that the bile from the right lobe passes through the gall-bladder in its way to the common duct, or duodenum, and a third variety, in which both hepatic ducts emptied directly into the gall-bladder and thus all the bile passed through the gall-bladder on its way to the duodenum (vol. i, p. 127).

*Absence of Common Duct.*—CASE VIII.—After an easy and natural labor of some four hours' duration, she was delivered of a well-developed boy weighing

a little over 9 pounds. For the twenty-four hours after birth, the child betrayed no abnormal symptoms. At my next visit, however (about thirty hours after delivery), I noticed an icteric appearance of the countenance, and upon closer inspection a well-marked yellow tinge on the whole surface was discovered. The nurse informed me that the discharges from the bowels were "almost like clay" and that the child had frequent attacks of vomiting. The symptoms continued to grow worse. The color of the skin changed to a brownish-yellow or bronze. The irritability of the stomach increased, convulsions supervened and in about twelve hours after my second visit, or seventy-two hours after birth, the child died in profound coma.

Sectio cadaveris, the tissues throughout the body were stained intensely yellow. The liver was swollen and enlarged. This was evidently due to distention of the biliary duct, as upon cutting into it an unusual amount of very thick bile oozed from the cut surface. The gall-bladder occupied its normal position and was enormously distended with bile of about the consistency of syrup. The cystic and hepatic ducts presented nothing unusual except that they were very much enlarged, a point I shall allude to again. They united at the usual place to form the common duct, the ductus communis choledochus also was very greatly distended and was about  $\frac{3}{4}$  inch long; it then terminated abruptly in a very blunt, club-shaped extremity, without reaching the intestinal wall at all. (I. N. Danforth: Chicago Med. Jour., vol. xxvii, p. 110, 1870.)

GESSNER (Ueber Congenitalenverschluss der Grossen Gallengange, Halle, 1886), after collecting the reports of 24 cases of congenital obliteration of the major bile passages, to which a twenty-fifth case, his own, was added, reached the following conclusions:

1. That so far no undoubted case of congenital obliteration of the major bile passages has been observed.
2. That many so-called cases are of uncertain etiological origin.
3. That the most certain, if not satisfactory, explanation for the so-called malformations, is a condition that is luetic in origin.

AUTHOR'S COMMENT.—None of Gessner's cases, in the writer's opinion, justified acceptance. All were in infants of a few weeks to a few months of age. A number were outspoken luetic, others doubtful, and still others more remotely doubtful. The cases suggested a luetic perihepatitis that has its origin during the fetal period of existence and resulted in an atresia rather than a malformation. In fact some of Gessner's cases were entirely free from jaundice at birth.

#### CONCLUSIONS

1. Refinements in operative and diagnostic technic demand a detailed knowledge of the anomalies of abdominal organs, and therefore it behooves us to more fully investigate and report the various anomalies as they present themselves.
2. A more thorough search should, if possible, be made at the time

## ANOMALIES OF THE GALL-BLADDER AND BILE-PASSAGES

of operation, and the operative procedure, carried out through an incision yielding a more accurate survey of the field of activity.

3. The "button-hole incision" is not alone responsible for incomplete surgery, but through its employment many anomalies are overlooked.

4. Anomalies of the hepatic region follow the rule of anomalies in other regions in not occurring singly, *i.e.*, an anomaly of the gall-bladder may have an attending anomaly of the ducts or the blood supply or some other part of the hepatic system.

5. A double gall-bladder is one in which each gall-bladder has its independent cystic duct, thus differentiating it from a bifid gall-bladder in which the cavities are distinctly separate, but communicate with the common duct through a single cystic duct.

6. Five cases of double gall-bladder are recorded. Of these, one case was without other anomalies. Of those in which other anomalies were present (Case I) there existed, in addition to the double gall-bladder, an anomaly of the hepatic duct, which, instead of dividing into two branches, divided into three, right, left and posterior, and these ducts did not communicate with one another, but were distinct in their whole course. Case II, one gall-bladder was located on the right lobe and the other on the left lobe. Case III, there occurred a subdivision of one of the cystic ducts. Case V, there existed a mesentery, one blade of which became lost over the duodenum and the other over the hepatic flexure of colon.

7. In a bilobed gall-bladder the cavity consists of two lobes with a single cystic duct. Of this anomaly there is one recorded case.

8. In a diverticulum of the gall-bladder there is one large cavity and a smaller recess communicating with the larger or true gall-bladder cavity.

9. Seven cases of diverticulum of gall-bladder are recorded. Of these, 5 cases were simple and 2 cases complicated. Case II was complicated by a division of the common duct just beyond the entrance of the cystic duct; Case III by unusual vascular anomalies.

10. An intrahepatic gall-bladder is partly or entirely imbedded in the liver substance instead of merely occupying the classical gall-bladder depression. Of this anomaly 16 uncomplicated cases are recorded.

11. A completely imbedded gall-bladder may be confused with a left-sided or absent gall-bladder. According to D  v  , this anomaly is most common in infants and reptiles.

12. A left-sided gall-bladder occupies a position to the left of the falciform ligament in a normally placed liver. Of this anomaly 13 cases

are recorded. Seven cases were uncomplicated. Case II was complicated by an abnormal arrangement of the caudate and quadrate lobe, Case IV by an ectopia of gall-bladder. Cases VII and VIII by vascular and lobar anomalies. Case IX by absence of quadrate lobe. In Case XIII two gall-bladders existed, one on the right and the other the left lobe.

13. A left-sided gall-bladder may be concealed behind the falciform ligament and at an operation be overlooked entirely, or confused with a congenital absence, extreme fibrosis, or an intrahepatic gall-bladder.

14. In transposition of viscera, the liver not only occupies the left instead of the right hypochondrium, but there is a reversal of the lobe, the left being larger than the right and receiving the gall-bladder. There is a dextroposition of the heart, as well as reversal of the duodenum and stomach, which becomes our most important diagnostic aid. Of this anomaly, 11 cases are recorded.

15. A floating gall-bladder has a distinct mesentery and is usually attended with a wide range of mobility. Of this anomaly there are eight cases recorded.

16. Absence of gall-bladder includes only cases of agenesis or congenital absence, as opposed to absence due to destruction through pathologic process. There are 7 cases of this anomaly recorded. Of these, Cases II and VII were complicated by the absence of quadrate lobe.

17. Absence of gall-bladder is common in some animals, elephant, rhinoceros, camel, goat, deer, some species of fish, some birds, and some rodents (Eschner).

18. There were no cases of congenital hour-glass gall-bladder discovered. Several cases are on record occasioned by pathologic processes.

19. There were eight cases of anomaly of bile passages as follows: 2 cases of double cystic duct; 5 cases of anomalies of hepatic ducts, and 1 case of absence of common duct.

20. The total anomalies numbered 76, of which 62, or 81+ per cent., were single, and 14, or 18+ per cent., were multiple.

#### BIBLIOGRAPHY

- Giese, O.: Ueber Defect and Congent. Obliteration der Gallenausfirengsgange, Bonn 80, Leipsic, 1896.  
 Cruicknell, H. H.: Tr. Path. Soc. Lon., 1870, 1, xxii.  
 Cruveilhier, E.: Bul. Soc. Anat. de Paris, 1860, xxxv.  
 Weltz, G. H.: Ueber Divertikel der Gallenblase, Kiel, 1894.  
 Walton, A. G.: Malposition Gall-bladder. Lancet, 1912, vol. i.  
 Purser: British Medical Journal, 1886.

## ANOMALIES OF THE GALL-BLADDER AND BILE-PASSAGES

- Danforth, J. N.: Absence of Duct. Commun. Choledochus. Chicago Med. Journ., 1870, xxvii.
- Morgan, J. H.: Case of Congenital Malformation of the Common Duct. Tr. Path. Soc., London, 1878, xxix.
- Eshner, A. A.: Congenital Absence of the Gall-bladder. Med. News, Phil., 1894, lxiv.
- Latham, A.: Absence of Gall-bladder. Proc. Anat. Soc., Gr. Britain and Ireland, London, 1898.
- Gessner, E.: Ueber Congenitalenverschluss der grossen Gallengänge, Halle, 1886.
- Hochstetter, Ferdinand: Anomalien der Pfortader und der Nabelvene in Verbindung mit Defect oder Linkslage der Gallenblase. Archiv für Anatomie und Physiologie, 1886.
- Dévè, F.: De quelques particularités anatomiques et anomalies de la vésicule biliaire. Bulletins de la Société Anatomique de Paris, 1903.
- Lemon, F.: The Lancet, May 13, 1905.
- Sherren, James: A Double Gall-bladder Removed by Operation. ANNALS OF SURGERY, vol. liv.
- Förster, August: Missbildungen des Menschen. Jena, 1861, p. 125.
- Klebs: Handbuch des Pathologischen, Anatomie, 1869.
- Meckel, J. F.: Handbuch der Menschlichen Anatomie, 1820, Band iv.
- Von Sömmering, T. H.: Vom Bau des menschlichen Korpes, v Band, 1844.
- Dressmann: Beitrag zur Kenntnis der Kongenitalen Anomalien der Gallenwege. Deutsche Zeitschrift f. Chirurgie, vol. xcii, 1908.
- Horn, Harry W.: Situs Viscerum Inversus with Gall-stones. ANNALS OF SURGERY, lxii.
- Brewer, Geo. E.: Anatomy of Gall-bladder and Ducts. ANNALS OF SURGERY, vol. xxix.
- Deaver and Ashhurst: Surgery of the Upper Abdomen, vol. ii.
- Kehr, Hans: Die Praxis der Gallenwege Chirurgie, Bd. I und II.



# THE INTERPRETATION OF FUNCTIONAL RENAL TESTS WITH SPECIAL REFERENCE TO THE SIGNIFICANCE OF MINIMAL EXCRETION OF PHTHALEIN AND INDIGO- CARMIN \*

BY EDWIN BEER, M.D.  
OF NEW YORK CITY

(From the Mt. Sinai Hospital Surgical Service)

THE last word in functional renal tests is still far off. In the meanwhile conscientious study will clear the way to that goal. The practical value of these tests becomes more and more evident as one succeeds in improving the interpretation of the facts elicited. In research along these lines one encounters many puzzling contradictions and it will take much more work to explain many of them. Why a given kidney (*e.g.*, a case of ureter stone) secretes more urea than its mate, but fails to excrete indigo-carmin while its mate does it normally, or why a patient dies of uræmia while the phthalein output is normal or almost normal illustrate some of the perplexities that one encounters. As the above are exceptional occurrences the important practical point in all this work, it seems to me, is *to arrive at an understanding of the significance of zero or minimal excretions*, so that we may be guided intelligently and thus get the best possible operative results. This viewpoint has not received the attention it deserves. In the discussion of the paper of J. T. Geraghty before the Genito-Urinary Section of the American Medical Association in 1912, I suggested the appointment of a central committee which would gather cases and investigate the significance of all negative (zero or minimal excretion, etc.) test results. As nothing was done along these lines I have continued to give this point my particular attention during recent years and have had the opportunity of studying a number of such cases. Unless one has a very large material it is difficult to gather a convincing array of evidence along these lines. I feel that my series of cases should be recorded in the hope that they will stimulate others to

---

\*Read before the N. Y. Surgical Society, April 12, 1916. This article is practically an experimental laboratory study, based on carefully studied clinical material. The observations will be fully but briefly stated so that the reader may check up the validity of the deductions.

## FUNCTIONAL RENAL TESTS

gather facts along the same lines and thus aid in establishing firmly the significance of zero or minimal excretions.

Fortunately positive results, *i.e.*, good excretion of test substances, usually mean good function. Occasionally hyperfunction, however, may accompany severe disease and be very misleading. In 1908<sup>1</sup> in a paper referring to the influence exerted by a diseased kidney on the excretory work of the second organ, I called attention to this difficulty. Since then Baetger has emphasized this in his presentation of cases of hyperpermeability, and Ellis Foster in his series of cases dying of uræmia with high phthalein output. This phase of the question will not be discussed any further in this paper. It will be evident from a perusal of the following cases that every case in which the output of phthalein or of indigo-carmin is minimal must be carefully analyzed, as in this group of cases careless study and false deductions will lead to unwise operative measures which will be followed by a very, and, unnecessarily, high mortality.

In the following pages the cases will fall into natural groups:

(a) In the first group will be described a series of cases in which there was minimal excretion of test substances, etc., due to symmetrical<sup>2</sup> renal disease usually caused by obstruction, *e.g.*, adenoma of the prostate, stricture of the urethra, interstitial cystitis, etc., and in which preliminary treatment failed to improve renal output and a fatal ending ensued (or threatens), due to renal insufficiency (Cases I to VI).

(b) In the second group similar cases in which preliminary therapy succeeded in restoring function and in which operation could be successfully performed (Cases VII and VIII).

(c) In the third group cases in which the lowered output was due to inhibition toxic or reflex, and on the basis of this interpretation, operation (successful) was permissible (Cases IX to XII).

(d) In the fourth group cases of more or less a symmetrical renal involvement in which the kidney or kidneys had to be directly attacked before any improvement in renal function was to be expected. Success in this group of minimal excretion cases depended, I believe, on rapidity of operation, substitution of gas and oxygen anæsthesia (or spinal or local) for ether and adequate drainage so as to avoid wound infection (Cases XIII to XVII).

---

<sup>1</sup> Beer, E.: The Phloridzin Test with Special Reference to the Influence Exerted by a Diseased Kidney on the Excretory Work of the Second Organ. Jour. Am. Med. Assn., 1908, 1, 1975.

<sup>2</sup> Palpation, X-ray cystoscopy, etc. (autopsy).

EDWIN BEER

GROUP A

CASE I.<sup>2</sup>—H. S., aged sixty years, admitted February 12, 1912. Died May 26, 1912.

*Diagnosis: Prostatic adenoma, cystitis, vesical calculi, bilateral hydro-ureter and hydronephroses, uræmia.*

For past year has had attacks of frequency and of burning on urination. Three weeks ago a number of vesical calculi were evacuated through the sheath of the cystoscope. Of late, frequency is very great, every hour or half hour, and has pain over bladder.

The patient's general condition appears good and does not suggest a renal insufficiency. He is well nourished. There is moderate arteriosclerosis and moderate increase in tension.

X-ray of genito-urinary tract is negative. Palpation of the kidneys is negative.

February 13, 1912: Cystoscopy shows a diffuse cystitis and numerous small calculi (uratic). The prostate is enlarged. Many stones washed out of bladder through sheath of cystoscope. Regular catheterizations and bladder washings employed.

February 14, 1912: *Phthalein test* (No. 1). No excretion, urine collected for four hours twenty minutes. Urine contains pus and albumin.

February 15, 1912: *Phthalein test* (No. 2). No excretion. Urine collected for two hours twenty-five minutes.

February 16, 1912: *Phthalein test* (No. 3). Faint trace excreted after one hour.

February 16, 1912: *Phloridzin test* (minims 15 of 1 per cent. solution). No sugar excreted in fifty-three minutes.

*Indigo-carmin test* (No. 1) (drachms 3 of 0.4 per cent. solution). No coloring matter in urine until three hours fifty minutes, when faintest color appeared.

*Urea output* was 1 per cent. = 18.6 grammes in twenty-four hours.

In spite of attempts to relieve his kidney insufficiency, nothing was accomplished and patient, refusing further treatment, went home. He was readmitted May 10, 1912. He had felt fairly comfortable for one month after discharge, but during the last two months he had become worse again and had become incontinent. Now a permanent catheter was introduced. His eye grounds were negative. Urine contained pus and albumin.

May 13, 1912: *Indigo-carmin test* (No. 2). After three hours forty minutes, a faint excretion appeared.

*Urea output*: 1.1 per cent. or 17.6 grammes.

---

<sup>2</sup> Histories are abbreviated.

## FUNCTIONAL RENAL TESTS

May 16, 1912: *Phthalein test* (No. 5). After five hours there was the faintest excretion.

May 16, 1912: About 100 small stones removed from the bladder through the sheath of the cystoscope. With lithotrite some larger stones crushed and evacuated (novocaine local anæsthesia). Operation was brief and three separate instruments were introduced into the bladder, each only once, cystoscope, lithotrite and again cystoscope. There was no injury and patient was not excited.

May 17, 1912: Patient is dull and quiet; distinctly uræmic. Tongue is dry; vomited several times.

May 20, 1912: Under active treatment patient improved and came out of his acute uræmic state.

*Phthalein test* (No. 6). After two hours fifteen minutes, faintest reaction. During the next 24 hours inestimable amount of phthalein was excreted.

May 22, 1912: *Urea output*: 1.2 per cent. or 11 grammes.

Without local anæsthesia many more stones rapidly evacuated without any injury and without any distress to the patient.

May 23, 1912: *Urea output*: 1.5 per cent. or 19 grammes.

May 25, 1912: Patient has again become duller, breathing labored, pulse weaker; passes less urine; placed on same treatment as before without avail.

May 26, 1912: Became more and more stuporous; breath urinous, and died in uræmia.

*Autopsy*.—Prostatic adenoma with hypertrophied bladder; marked cystitis and a few vesical calculi; hydro-ureter and hydronephroses on both sides, and atrophic contracted kidneys.

*Summary*.—In this case the prostatic adenoma had gradually led to a symmetrical supravescical renal destruction which showed itself by continued failure to excrete phthalein (six tests), indigo-carmin (two tests) and phloridzin glucose (one test). Despite removal of the stones and despite removal of the obstruction by employing an indwelling catheter, it became evident that the kidneys were permanently disabled and, even though the urea output was good, an operative attack on the prostate was absolutely contra-indicated.

CASE II.—D. G., aged sixty-six years, admitted October 29, 1913. Died November 13, 1913.

*Diagnosis*: Prostatic adenoma, chronic cystitis, hydro-ureter and hydronephroses on both sides, uræmia.

Until four years ago, well, when he was taken ill with gastric symptoms, pyrosis, eructations, vomiting; he became costive. There was neither headache nor visual disturbances. Marked in-

creased frequency developed and of late retention, which required catheterization. Since four weeks in bed because of weakness.

*Examination.*—General condition fair, emaciated, tongue dry. Heart sounds of fair force. Second aortic accentuated. Some general arteriosclerosis. At right apex signs of tuberculous process. Prostate was enlarged per rectum. There was slight œdema about ankles. Blood-pressure was 130 millimetres. Residual urine 9 ounces. X-ray examination is negative. Palpation of kidneys is negative.

*Therapy.*—Permanent catheter introduced and measures to combat the disturbance in kidney function instituted.

October 30, 1913: *Phthalein test* (No. 1). Negative; no excretion in twenty-four hours.

October 31, 1913: *Indigo-carmin test* (No. 1). Negative; no excretion. Urine drained in good amounts, contained slight trace of albumin and some pus-cells; urea 1.6 per cent.; in twenty-four hours 16.3 grammes.

November 1, 1913: *Phloridzin test* (No. 1). Negative; no sugar excretion in twelve hours.

November 3, 1913: Fundus examination shows slight changes commonly seen in chronic nephritis.

*Phthalein test* (No. 2). After three and one-quarter hours very faint reaction.

November 4, 1913: *Indigo-carmin test* (No. 2). No excretion in twenty-four hours.

November 5, 1913: *Phloridzin test* (No. 2). Very faintest glucose reaction at four hours.

*Albarran polyuria test* repeatedly negative.

November 11, 1913: *Phthalein test* (No. 3). Faintest excretion in four hours.

November 13, 1913: Despite attempts to restore the kidney function, the patient gradually became more uræmic, and died.

*Autopsy.*—Prostatic adenoma, chronic cystitis, hydro-ureter and hydronephroses, with extensive parenchymatous and interstitial nephritis.

*Summary.*—In this case, as in the previous one, the obstructive adenoma had led to a permanent disturbance in kidney function, by producing a symmetrical destruction of secreting parenchyma. In view of the fact that no improvement followed the use of a permanent catheter and the use of anti-uræmic measures, etc., it became evident that the outlook was most unfavorable, and that surgical measures were contra-indicated.



## FUNCTIONAL RENAL TESTS

CASE III.—W. J., aged forty-seven years, admitted November 18, 1915. Died December 22, 1915.

*Diagnosis: Old urethral stricture; multiple perineal sinuses and abscesses; chronic uræmia.*

Patient has been under irregular observation for a number of years and has had attacks of pyelonephritis from time to time. He entered the hospital complaining of abscesses in perineum which have developed from the urethra following stricture. On admission his general condition was good. His appearance did not suggest that he was on the verge of a fatal uræmia. Abscesses opened under local anæsthesia. Urine contained a trace of albumin and many pus-cells. X-ray examination and palpation of the kidneys were negative.

November 26, 1915: *Phthalein test* (No. 1). First appearance of dye in one hour fifty-five minutes. In two subsequent hours only traces excreted. *Blood urea* 96.6 milligrammes; incoagulable nitrogen 181.4 milligrammes per 100 cubic centimetres.

November 30, 1915: *Phthalein test* (No. 2). Excretion time one hour fifty-five minutes. In three subsequent hours only traces excreted.

December 2, 1915: Eye grounds show slight temporal pallor, otherwise normal (Dr. J. Wolff).

December 2, 1915: Blood pressure: systolic, 128 millimetres; diastolic, 107 millimetres.

Revision of suppurating sinuses under gas and oxygen anæsthesia. Introduction of permanent catheter past the obstruction to determine whether kidneys were temporarily or permanently damaged.

December 4, 1915: *Phthalein test* (No. 3). Excretion time two hours fifteen minutes. In two subsequent hours only traces were excreted.

December 7, 1915: *Phthalein test* (No. 4). Excretion time three hours. Only traces excreted.

*Blood urea*, 88.2 milligrammes; incoagulable nitrogen, 101.5 milligrammes per 100 cubic centimetres.

December 10, 1915: *Phthalein test* (No. 5). Only traces excreted.

During these days total output of urine varied from 63 ounces to 19 ounces. The patient was becoming distinctly weaker and more apathetic. His tongue was usually dry and appetite poor.

December 10, 1915: Total urine, 1024 cubic centimetres; urea, 0.7 per cent.

December 13, 1915: *Phthalein test* (No. 6). Only traces excreted.

Blood-pressure: systolic, 98 millimetres; diastolic, 75 millimetres.

December 16, 1915: *Phthalein test* (No. 7). Excretion time two hours forty-five minutes. In two subsequent hours traces, but no estimable amount excreted.

December 18, 1915: *Alveolar air*,  $\text{CO}_2 = 5.4$  per cent.

December 20, 1915: *Phthalein test* (No. 8). Excretion time two hours thirty-five minutes. In two subsequent hours about 6 per cent.

December 22, 1915: Patient decidedly worse. Pulse feeble. Babinski on right side. Respirations shallow. Stupor has set in. Marked oliguria (4 ounces in last twenty-four hours). Death in coma.

*Summary.*—As the result of an old stricture which had been neglected, this patient developed bilateral pyelonephritis which ended in a distinct renal insufficiency. This showed itself definitely in the test of renal function and was not suspected until these tests were made, as the general appearance and physical examination did not suggest an impending uræmia. An attempt was made to restore the kidney function, first by draining the areas of suppuration from which toxic materials were being absorbed, and second by relief of the obstruction to the urinary outflow by employing an indwelling catheter. Both attempts failed to bring about any material improvement, though the retention in the blood dropped slightly and the phthalein output increased a few points. This lack of response to measures aiming at restoration of function led to the conclusion that the changes in the kidneys were of a permanent character and the fatal outcome bore out the conclusions reached.

CASE IV.—I. W.,<sup>4</sup> aged sixty-one years, admitted November 2, 1914. Died November 23, 1914.

*Diagnosis:* *Carcinoma of prostate, chronic nephritis, uræmia.*

Three years ago acute retention. Since then frequency, some dysuria. Three weeks ago hypogastric pain, loss of appetite, nausea, vomiting. Lost eighteen pounds during past eight months.

As patient has almost absolute retention a permanent catheter was introduced and subsequently suprapubic puncture made. His general condition was fair and did not suggest uræmia. X-ray examination and palpation of the kidneys were negative.

His urine contained blood-cells (traumatic), a trace of albumin, and some finely granular casts. He passed as much as 1500 cubic centimetres containing 1 per cent. urea or 15 grammes in 24 hours.

<sup>4</sup>Through the courtesy of Dr. C. A. Elsberg, this case was studied by the writer.

## FUNCTIONAL RENAL TESTS

November 3, 1914: *Phthalein test* (No. 1). First appearance in one hour. In subsequent two hours, 4.5 per cent.

November 5, 1914: *Phthalein test* (No. 2). No excretion in twelve hours.

November 7, 1914: Fundus examination: optic discs have a slightly blurred and woolly outline, which may indicate the beginning of a low grade neuritis (Dr. J. Wolff).

November 8, 1914: 66 ounces of urine secreted; urea, 1.2 per cent.

November 10, 1914: *Indigo-carmin test*: No excretion.

November 13, 1914: Blood-pressure, 135 millimetres.

November 14, 1914: *Phthalein test* (No. 3). In three hours 5 per cent. excreted.

November 16, 1914: *Phloridzin test* (No. 1). Gr. 1/10 injected. No glycosuria in next twenty-four hours. *Blood urea*, 88 milligrammes; incoagulable nitrogen, 100 milligrammes per 100 cubic centimetres.<sup>5</sup>

November 18, 1914: *Phloridzin test* (No. 2). Gr. 1/6 injected. No glycosuria in next twenty-four hours.

November 23, 1914: Patient gradually became comatose and died in uræmia.

*Summary.*—In this patient, as in the previous three, it was impossible to repair the damage done to the two kidneys by the longstanding obstruction to the outflow of urine. Even though this back pressure was relieved by permanent catheter, all the tests remained practically negative and it soon became evident that a fatal uræmia would develop.

CASE V.—M. G., aged forty-eight years, admitted May 7, 1915. Died February 21, 1916.

*Diagnosis:* Chronic interstitial (contracted bladder) cystitis, bilateral nephritis, uræmia.

Patient had bladder symptoms for more than twenty years. Suprapubic cystostomy fourteen years ago gave no relief. Capacity of bladder very small and frequency very great. Has lost much weight and become weak. Patient looked pale and waxy, suggesting a chronic intoxication. His urine contained a heavy trace of albumin, red-cells and pus-cells. X-ray examination and palpation of the kidneys was negative.

May 22, 1915: Fundi show low grade optic neuritis with a few small scattered hemorrhages in retina (Dr. J. Wolff).

May 25, 1915: *Phthalein test* (No. 1). No excretion of phthalein.

---

<sup>5</sup> Dr. Lautman made most of the blood analyses.

May 27, 1915: Blood-pressure: systolic, 180 milligrammes; diastolic, 90 milligrammes.

Permanent catheter too painful. Cystostomy to relieve back pressure refused by patient.

May 28, 1915: *Indigo-carmin test* (No. 1). No excretion.

May 31, 1915: *Phthalein test* (No. 2). No excretion.

Patient left the hospital on June 3, 1915, in practically the same condition and suffering from chronic uræmia.

September 13, 1915: Readmitted. During past two months his condition has become worse. He has lost twenty pounds and has more pain and greater frequency.

September 14, 1915: *Phthalein test* (No. 3). Traces of phthalein excreted in four hours.

September 15, 1915: Blood urea nitrogen, 77 milligrammes; incoagulable nitrogen, 120 milligrammes per 100 cubic centimetres.

September 17, 1915: Discharged and returned to hospital ten days later, feeling just as he did on last admission, but complaining, in addition, of dyspnoea and œdema about ankles. To relieve back pressure from the irritable, contracted bladder, catheters had proven unavailing and now it was decided to perform a cystostomy.

October 2, 1915: Suprapubic cystostomy under local anæsthesia.

Optic neuritis more marked than on May 22, 1915 (Dr. J. Wolff).

October 5, 1915: Large amounts, up to 108 ounces, drained. Urea concentration varies from 1.1 per cent. to 0.2 per cent.; specific gravity, 1011 to 1005; macroscopic pus; traces of albumin.

October 7, 1915: *Phthalein test* (No. 4). Traces of phthalein excreted.

October 10, 1915: *Indigo-carmin test* (No. 2). In one hour twenty-five minutes, faint traces appeared. (Previously none appeared; *v. supra.*)

October 12, 1915: Blood urea nitrogen, 74.2 milligrammes, and incoagulable nitrogen, 93 milligrammes per 100 cubic centimetres.

*Phthalein test* (No. 5). Only traces excreted in four hours.

October 16, 1915: *Phthalein test* (No. 6). Only traces excreted in three and one-half hours.

November 3, 1915: *Indigo-carmin test* (No. 3). Faint traces present in one hour ten minutes.

October 20, 1915: *Phthalein test* (No. 7). Only traces excreted.

October 26, 1915: *Phthalein test* (No. 8.) Only traces excreted.

November 1, 1915: *Phthalein test* (No. 9). Only traces excreted.

## FUNCTIONAL RENAL TESTS

November 5, 1915: Blood-pressure: systolic, 235 milligrammes; diastolic, 110 milligrammes.

Despite relief of back pressure by cystostomy it had become evident from the almost complete lack of response of the kidneys, that the renal damage was permanent, and as the drainage caused discomfort the wound was allowed to close, which it did slowly.

November 6, 1915, to December 14, 1915: *Phthalein tests* (Nos. 10 to 18) were made and always only faintest traces of the dye were excreted.

December 14, 1915: The patient was discharged in miserable condition and kept under observation in his home. His dyspnoea became more marked and a general anasarca set in, so that patient was readmitted on January 30, 1916, in worse condition than he had been when last in the hospital.

February 21, 1916: Died in uræmic coma.

*Summary.*—Here again the minimal excretion due to symmetrical supravescical disease pointed to a fatal ending. The case is particularly interesting because of the long period the patient lived with practically zero excretion. To what extent the relief of back pressure by the cystostomy helped to prolong life it is difficult to say.

CASE VI.—S. E., aged twenty years, admitted December 27, 1915.

*Diagnosis:* *Bilateral infected hydro-ureter and hydro-nephroses; nephritis; uræmia.*

Since four years has pyuria. Since seven weeks headaches, nausea, vomiting and epistaxis. Has pains in bladder and right lumbar region. The patient's appearance does not suggest renal insufficiency. He is, however, markedly pale. Urine contains a good trace of albumin, pus-cells and granular casts.

December 28, 1915: Blood urea nitrogen 131 milligrammes; incoagulable nitrogen, 200 milligrammes per 100 cubic centimetres.

*Phthalein test* (No. 1). Only traces excreted in three hours forty-eight minutes.

December 30, 1915: Cystoscopy shows a non-trabeculated, pale bladder with practically no residual urine. Both ureter meati are dilated. Faint indigo-carmin excretion from left kidney in one hour. Specimen from left kidney—urea, 0.8 per cent.; occasional cells and hyaline casts.

December 31, 1915: Blood-pressure: systolic, 148 milligrammes; diastolic, 85 milligrammes.

January 4, 1915: *Phthalein test* (No. 2). Only traces excreted.

January 12, 1916: *Indigo-carmin test* (No. 2). Faintest trace of indigo excreted. Catheter (No. 12 F.) passed into right pelvis



37 centimetres and watery secretion collected. This specimen contained urea, 0.5 per cent., and a few hyaline and granular casts. Interesting to relate despite this very evident renal insufficiency the patient successfully withstood a rather sharp infection of his antrum as well as of both middle ears.

*Summary.*—In this unusual case of non-obstructive symmetrical renal disease, therapeutically nothing could be done to relieve the condition, as it was not due to excessive back pressure. How long this patient will live cannot be predicted, as the process of destruction of the remnant of parenchyma may be accelerated or delayed. The marked blood retention, together with the minimal output of test substances, point, however, to a fatal ending in the near future.

## GROUP B

CASE VII.—M. A., aged sixty-four years, admitted November 24, 1915. Discharged January 12, 1916.

*Diagnosis:* *Contracture (spinal?) of neck of bladder.*

Difficulty in urination for twenty-seven years. Occasionally attacks of painful urination. During past three months urine is cloudy, and œdema of face and of legs has developed. There are anorexia and headaches. The bladder remains full after voiding small amounts. Residual urine is 1000 cubic centimetres. Rectally, prostate is small. Patient at first regularly catheterized and then permanent catheter used.

November 25, 1915: *Phthalein test* (No. 1). In three hours 4 + per cent. excreted.

November 26, 1915: Blood urea nitrogen, 37 mgms.; incoagulable nitrogen, 56 mgms.; creatinin, 1.5 mgms.; uric acid, 5.6 mgms. per 100 cubic centimetres (Dr. Bernhard).

November 27, 1915: X-ray of the genito-urinary tract was negative. Palpation of kidneys was negative.

November 29, 1915: Cysto-urethroscopy shows trabeculated and diverticulated bladder moderately inflamed. At sphincter margin minute nodule (adenoma?) and only slight intra-urethral enlargement of prostate.

November 29, 1915: *Indigo-carmin test* (No. 1). No indigo appeared in urine within seven hours of injection.

December 1, 1915: *Phthalein test* (No. 2). Total 6 per cent. excreted. Total urine, 3900 cubic centimetres; specific gravity, 1.012; urea, 0.95 per cent. (37 grammes).

December 3, 1915: *Phthalein test* (No. 3). Total 23 per cent. excreted.

## FUNCTIONAL RENAL TESTS

December 5, 1915: *Phthalein test* (No. 4). Total 12 per cent. excreted.

December 7, 1915: *Phthalein test* (No. 5)). Total 31 per cent. excreted.

December 9, 1915: *Phthalein test* (No. 6). Total 39 per cent. excreted.

December 11, 1915: *Phthalein test* (No. 7). Total 32 per cent. excreted.

*Indigo-carmin test* (No. 2). Good excretion and in strong concentration.

Blood urea nitrogen and incoagulable nitrogen normal.

December 13, 1915: suprapubic cystostomy under local anaesthesia.

December 15, 1915: *Phthalein test* (No. 8). Total 32 per cent. excreted.

December 18, 1915: *Phthalein test* (No. 9). Total 35 per cent. excreted.

December 20, 1915: Suprapubic removal of small nodule at sphincter margin and wide stretching of the contracted neck, from which the patient made a satisfactory recovery without any signs of renal insufficiency.

*Summary.*—In this case as the result of many years obstruction at the neck of the bladder a symmetrical renal disturbance seems to have developed and this showed itself both in the minimal output of test substances, but also in the general toxic symptoms. Under regular catheterizations and under permanent catheterization, it soon became evident that the renal damage was not a permanent loss of function. There was a steady improvement in the output of both indigo-carmin and of phthalein, and *pari passu* the general condition improved. With this evidence of the recuperative power of the kidneys, operation for relief of the causative agent was successfully done without development of any symptoms of renal insufficiency.

CASE VIII.—W. B., aged seventy years, admitted January 1, 1914. Discharged January 10, 1914. Readmitted March 22, 1915. Discharged May 21, 1915. Readmitted June 22, 1915. Discharged July 20, 1915.

*Diagnosis:* Vesical calculus; prostatic adenoma.

January 1, 1914: Patient suffering from symptoms of prostatic adenoma and bladder stone. Residual urine ounces, 10.

January 2, 1914: *Phthalein test* (No. 1). Appearance in thirty minutes, next two hours 27 per cent.

January 6, 1914: *Phthalein test* (No. 2). Appearance in thirty-five minutes, next two hours 27 per cent.

X-ray shows stone in bladder as large as hen's egg. X-ray of kidneys and palpation were negative.

January 10, 1914: Patient refused operation and was discharged.

Readmitted March 22, 1915, in much worse condition.

For more than two years patient had been carrying a vesical calculus which had grown to a very large size. His prostate was large and his urine contained pus, red-cells, trace of albumin, specific gravity, 1026, urea, 0.5 per cent. (amount ounces, 81).

March 24, 1915: *Phthalein test* (No. 3). First appearance in two hours twenty-five minutes. Total in subsequent two hours about 5 per cent.

In view of the impossibility of relieving the kidneys by use of indwelling catheter, it was determined to remove the very large stone which acted as the obstructive factor.

Cystostomy and removal of very large calculus which was firmly held by the contracted and thickened bladder (under local anaesthesia).

March 25, 1915: *Indigo-carmin test* (No. 1). Very faint excretion in two hours thirty-five minutes. Intensity remained minimal (and did not become stronger on oxidation).

*Phloridzin test* (No. 1). Specimens collected (seventeen in all) every fifteen minutes for three and one-half hours and no glycosuria detected.

Blood pressure: systolic, 160 milligrammes; diastolic, 90 milligrammes.

March 26, 1915: *Phthalein test* (No. 4). Appearance in one hour fifty minutes. In subsequent two hours, 8 per cent.

March 29, 1915: *Phthalein test* (No. 5). Appearance in one hour fifteen minutes. In subsequent two hours, 10 per cent.

Blood urea nitrogen 46.4 milligrammes; incoagulable nitrogen, 75 milligrammes per 100 cubic centimetres.

March 30, 1915: *Indigo-carmin test* (No. 2). In one hour fifty-five minutes indigo appeared in urine in stronger concentration than at first test.

April 6, 1915: *Phthalein test* (No. 6). Appearance in one hour thirty-five minutes. Total in next two hours dropped again to 5 per cent.

April 8, 1915: *Indigo-carmin test* (No. 3). Appearance in forty-five minutes. Within two and one-half hours dark blue, strong excretion. Meanwhile patient's general condition was improving.

April 9, 1915: Blood urea nitrogen, 46.4 milligrammes; incoagulable nitrogen, 74.9 milligrammes per 100 cubic centimetres.

## FUNCTIONAL RENAL TESTS

April 13, 1915: *Phthalein test* (No. 7). Appearance in forty-five minutes; next two hours, 10 per cent.

Blood pressure: systolic, 155 milligrammes; diastolic, 100 milligrammes.

May 18, 1915: Patient has steadily improved in general health. *Phthalein test* (No. 8). Appearance in twenty-five minutes; next two hours, 45 per cent.

May 21, 1915: Patient allowed to go home with cystostomy opening and instructed to return for prostatectomy.

June 22, 1915: Readmitted and successful prostatectomy performed.

*Summary.*—This patient on his second admission demonstrated a progressive disturbance of kidney function. Whereas at his first admission he was in fairly good condition and passed plenty of the test substance, on his second admission his excretion was minimal. It was evident that as long as the giant calculus remained in his bladder, back pressure against the kidneys could not be relieved, and it was therefore determined to remove this calculus under local anæsthesia. After relieving this condition, it became evident that the kidney function was only temporarily disturbed, and as the kidneys excreted more and more indigo-carmin, and more and more phthalein at each successive test, the patient's general condition improved sufficiently to allow of a successful prostatectomy. Had the tests, however, remained unchanged, had the kidneys shown a permanent loss of function, such an operation would have been contra-indicated.

## GROUP C

CASE IX.—W. F., aged sixty-four years. Admitted March 12, 1913. Discharged July 28, 1913.

*Diagnosis:* *Adenoma of prostate; calculous pyonephrosis.*

For ten years patient had frequency and dysuria. He had passed gravel and blood. Examination showed an almost impassable urethral stricture, and, as patient was septic, with petechial rash, on

March 19, 1913: A suprapubic cystostomy was performed, preliminary to the proposed secondary prostatectomy.

Blood pressure: systolic, 185 milligrammes.

Fundus examination negative (Dr. J. Wolff).

Blood culture negative.

Urine: Specific gravity, 1008; urea, 1.2 per cent.; much pus; good trace of albumin.

March 31, 1913: *Phthalein test* (No. 1). Thirty-seven per

cent. in two hours. Patient's condition improved sufficiently to allow on

April 23, 1913: Prostatectomy for adenoma.

April 30, 1913: *Phthalein test* (No. 2). Thirty-five per cent. in two hours.

May 13, 1913: Of late irregular temperature up to 102.4° F.

X-ray of kidneys shows large branching calculus of right kidney.

June 13, 1913: *Phthalein test* (No. 3). Faintest trace excreted.

June 23, 1913: Cystoscopy shows pure pus coming from the right kidney. Clear urine from the left kidney which excreted indigo-carmin in eleven minutes. No indigo excreted by right kidney. Conclusion: Patient was living on left kidney.

June 25, 1913: Nephrectomy for calculous pyonephrosis. Gas and ether anaesthesia. The kidney was shrunken. Practically no parenchyma present.

July 7, 1913: Uneventful recovery.

July 16, 1913: *Phthalein test* (No. 4). In two hours 30 per cent. excreted.

July 28, 1913: Discharged well.

*Summary.*—In this case, the phthalein excretion was adequate before the third test, when, perhaps as the result of a fresh infection of the right pyonephrotic kidney, a toxic or reflex inhibition of the second kidney set in and the phthalein excretion fell to a minimal amount. In view of the fact that the patient was living on his left kidney, it was concluded that this interpretation of the low output was correct and a nephrectomy was successfully performed. After removal of the diseased kidney, the inhibition being removed, the remaining organ functionated satisfactorily and passed a good quantity of dye stuff.

CASE X.—L. K., aged nineteen years, admitted December 15, 1915.

*Diagnosis: Right pyonephrosis.*

Painless hematuria two years ago. Gonorrhœa four months ago; pain in right lumbar region four days ago. Of late pain radiates to testis. Chill three days ago.

Examination showed a large mass in right kidney region. No temperature.

Urine contains albumin, pus, some red-cells; urea, 0.6 per cent.; no tubercle bacilli.

December 16, 1915: *Phthalein test* (No. 1). Total output, 5 per cent.

December 17, 1915: Cystoscopy: Diffuse cystitis. Right



## FUNCTIONAL RENAL TESTS

ureter easily catheterized; left ureter opening seen but no catheter enters. No *indigo-carmin* (test No. 1) excreted in forty-five minutes. Right ureter catheter left *in situ* and bladder urine drawn to give some idea of activity of left kidney. Right kidney—Urea, 0.4 per cent.; specimen milky with pus; after two hours tinge of blue. Left kidney (bladder)—Urea, 1.5 per cent.; indigo-carmin appeared in fair concentration between one and one-half to two hours.

December 18, 1915: Alveolar  $\text{CO}_2$  = 4.3 per cent.

Blood urea nitrogen, 72.8 milligrammes; incoagulable nitrogen, 157 milligrammes per 100 cubic centimetres.

December 19, 1915: *Indigo-carmin test* (No. 2). In one and one-third hours no excretion.

December 20, 1915: *Phthalein test* (No. 2). Total output, 7 per cent.

December 22, 1915: Nephrotomy for large right pyonephrosis. *Phthalein test* (No. 3). Total output, 15 per cent.

December 24, 1915: *Phthalein test* (No. 4). Total output, 25 per cent.

Blood urea nitrogen, 38.4 milligrammes; incoagulable nitrogen, 78.4 milligrammes per 100 cubic centimetres.

December 25, 1915: Blood pressure: systolic, 145 milligrammes; diastolic, 100 milligrammes.

December 26, 1915: *Indigo-carmin test* (No. 3). Good concentration within one hour.

January 12, 1916: *Indigo-carmin test* (No. 4). Good excretion in eight minutes.

January 15, 1916: Secondary nephrectomy for pyonephrosis. Gas and oxygen (plus one ounce of ether) anaesthesia.

January 22, 1916: *Phthalein test* (No. 5). Total output 32 per cent.

*Summary.*—In this case before drainage of the pyonephrosis, the opposite kidney functionated very poorly. This was due to either toxic or reflex influences, or both combined. As soon as the nephrotomy was performed a decided change took place, and the most striking improvement in function set in.

CASE XI.—F. F., aged thirty-eight years. Admitted December 28, 1915. Discharged January 22, 1916.

*Diagnosis: Obstructing ureteral calculus.*

Trouble began five days before admission with pain in left side and frequency of urination. Pain radiates and is paroxysmal; no fever.

EDWIN BEER

December 29, 1915: *Phthalein test* (No. 1). Total output  $7\frac{1}{2}$  per cent.

X-ray showed a stone blocking the upper end of the left ureter.

December 31, 1915: Cystoscopy performed after pains had become less severe. Indigo-carmin excretion from the right kidney was good. From the left kidney it was delayed and in feeble concentration. Right kidney—Urea, 2.4 per cent. Left kidney—Urea, 0.8 per cent.

*Phthalein test* (No. 2). Total, 20 per cent.

January 2, 1916: Pains in left kidney region are rapidly becoming less.

*Phthalein test* (No. 3). Total output, 25 per cent.

January 3, 1916: Again paroxysmal pains in left kidney apparently due to stone becoming impacted in ureteropelvic junction. Corresponding with this, rapid fall in the phthalein output.

*Phthalein test* (No. 4). Total output, 15 per cent.

January 5, 1916: Pyeloureterotomy for calculus, followed by considerable pain.

January 7, 1916: *Phthalein test* (No. 5). Total output, 12 per cent.

January 10, 1916: *Phthalein test* (No. 6). Total output, 8 per cent.

January 11, 1916: Drainage tube withdrawn.

January 14, 1916: *Phthalein test* (No. 7). Total output, 23 per cent.

*Summary.*—In this case the accession of paroxysmal pains in the left kidney reflexly disturbed the excretory activity of the second kidney. These pains were probably due to the stone becoming impacted at the ureteropelvic junction, and, when the impaction subsided, so did the inhibition, and correspondingly the output of indigo from the right kidney as well as the combined phthalein rose to higher values. After operation until the drainage tube was withdrawn, there was again a diminution in phthalein output and subsequently again a distinct rise. The behavior of this case reminds one of a similar case reported by J. Israel, in which there was marked oliguria reflexly produced by tube pressure against the pedicle of the nephrectomized side.

CASE XII.—E. B., aged forty years. Admitted January 11, 1916. Discharged February 15, 1916.

*Diagnosis:* Calculous pyelonephritis.

Two months history of left lumbar pains. One month later another attack of pain. Two weeks ago third attack. In this attack pain radiated to left leg, and there was great frequency.

## FUNCTIONAL RENAL TESTS

Urine—Trace of albumin, many hyaline casts, some red and white blood-cells. Right kidney—Granular casts; urea, 1.7 per cent. Left kidney—Much pus; urea, 0.4 per cent.

Blood urea nitrogen, 42 milligrammes; incoagulable nitrogen, 78.3 milligrammes per 100 cubic centimetres.

January 12, 1916: *Indigo-carmin test* (No. 1). Right kidney—Slightest tinge of color in thirty-two minutes. Left kidney—No color excretion in thirty-five minutes. Subsequently color did not become more intense, always only faintest excretion.

January 13, 1916: *Phthalein test* (No. 1). Total output, 5 per cent.

January 13, 1916: Fundus examination showed moderate degree of bilateral optic neuritis.

As patient was thoroughly septic, with high temperatures, nephrotomy, decapsulation and drainage for calculous pyelonephritis. Colon b. infection in the multiple abscesses.

January 21, 1916: *Phthalein test* (No. 2). Bladder urine output only a trace; drainage from left kidney, 8 per cent.

Patient is still very sick, high temperatures due to pneumonia. Blood culture negative.

February 2, 1916: General condition much better.

*Phthalein test* (No. 3). Output in four hours, 15 per cent.

February 11, 1916: Wound almost closed. *Phthalein test* (No. 4). Output in four hours, 41 per cent.

February 15, 1916: Discharged cured.

*Summary.*—In this patient the acute septic condition of the one kidney so influenced the opposite organ as to suggest renal insufficiency. In fact the second organ had become the seat of a nephritis. The markedly toxic condition of the patient on admission was part uræmic and part septic. After relieving the acute infection of the calculous kidney a gradual improvement set in and with this the renal output approached the normal.

## GROUP D

CASE XIII.—E. R., aged thirty-eight years. Admitted March 22, 1915. Died March 25, 1915.

*Diagnosis:* Bilateral congenital cystic kidneys; uræmia.

Malaria years ago when he lived in the South. Nine years before admission treated for cystitis. One and one-half years ago hematuria. Cystoscopy showed blood came from left kidney. Tumor of the kidney was suspected. Hematuria has been repeated twice. During this period a large nodular mass has developed below the left costal arch. It extends well below the umbilicus and reaches into the lumbar region. It is as large as an

adult head, slightly movable and not tender. The splenic flexure and descending colon run across the large tumor. Palpation of the tumor suggested a large spleen, and, despite the history of hematuria, until the ureters were catheterized it was not proven that the growth began in the left kidney. No other masses are palpable. Urine contained a faint trace of albumin.

March 22, 1915: Cystoscopy: *Indigo-carmin* absolutely negative. Catheter passed 30 centimetres up left ureter. No secretion. Some bloody fluid obtained. The right kidney secreted pale urine; urea, 0.5 per cent. *Phthalein test* on combined urines, faint trace excreted, amount not estimable.

These examinations showed that the tumor was in all probability of renal origin and that the patient was living on his other kidney. In view of his apparent excellent health, as well as the absence of all uræmic manifestations, the negative phthalein and negative indigo tests were looked upon as due to the reflex just discussed. As the patient was in a hurry to get rid of his neoplasm (hypernephroma?) the operation was performed before the blood urea report had come in.

March 23, 1915: Lumbar incision and puncture of numerous cysts of a congenital cystic kidney, under gas and ether (ounces 3 used).

Blood urea nitrogen, 107 milligrammes; incoagulable nitrogen, 161.7 milligrammes per 100 cubic centimetres.

March 24, 1915: Occasional vomiting. Despite active therapy only 10 ounces of urine passed. Patient stupid.

March 25, 1915: Distinctly uræmic. Only 1 ounce of urine passed. Died in coma fifty-two hours after the operation.

Autopsy showed the right kidney much enlarged and polycystic.

*Summary.*—In this case there was no suggestion of uræmia before the operation. The misinterpretation of the significance of the low output of the test substances led to the operation and its fatal result. The prognostic value of high urea retention in the blood is peculiarly significant and this together with the negative color tests and operative findings made it very clear that we were facing a critical situation. Directly after the operation, the contents of the blood which had been taken as the anæsthesia was begun, were reported and most active therapy was instituted to force both kidneys to eliminate. The few ounces of ether had, however, done their work and nothing availed.

In this case, therefore, a faulty interpretation of the significance of the negative phthalein and indigo-carmin tests led to a fatal operation. The use of ether, though in small amounts, undoubtedly contributed to the issue.

## FUNCTIONAL RENAL TESTS

CASE XIV.—M. G., aged fifty-two years. Admitted June 8, 1915. Died June 14, 1915.

*Diagnosis: Bilateral calculous pyelonephritis; uræmia.*

Five years' history of colics and of hematuria. Of late, rapid loss of strength, hematuria, oliguria and vomiting. Patient sent to hospital in wretched shape and immediate X-ray examination showed large stones in each kidney. Passed one ounce of blood and urine in four hours. Pulse scarcely perceptible.

Cystoscopy showed both kidneys passed large amount of albumin and pus, but that the left secreted more urea than the right. *Indigo-carmin test* absolutely negative. It was therefore determined to nephrotomize the better kidney under spinal anæsthesia, and leave the wound wide open, so as to avoid any serious local infection. Despite the almost moribund condition of the patient the nephrotomy was done and the stone removed. Following the operation there was an immediate though only temporary improvement. Vomiting ceased, pulse became better, left kidney passed much more urine (300 cubic centimetres in first twelve hours). Gradually, however, the uræmia asserted itself again and with a blood urea nitrogen of more than 200 milligrammes to the 100 cubic centimetres, the patient became weaker and died four days after the nephrotomy.

*Summary.*—In this patient, the clinical picture was clearly that of uræmia and the blood urea nitrogen as well as the indigo-carmin test only bore out the clinical impression. Unfortunately we are not able to distinguish the uræmic clinical picture when it is still in embryo, and it is under such circumstances that the tests will often help, if properly interpreted. Whether this patient's life could have been prolonged by a bilateral nephrotomy, is impossible to say. Her condition at operation was so poor that a bilateral operation could not be done.

CASE XV.—A. Z., aged thirty-eight years. Admitted December 23, 1915.

*Diagnosis: Left ureter calculus; left pyonephrosis; right calculous pyonephrosis.*

Fifteen years ago left renal colic. Five years ago colic on right side. Colic on left side repeatedly.

December 18, 1915: Severe pain in left flank, with chilly sensations and fever. Marked frequency.

General condition, on admission, good; temperature up to 102.4° F. Both kidneys enlarged, left kidney size of child's head and tender. Urine contains albumin and pus.

Right kidney—Urea, 1.5 per cent.; much pus. Left kidney—



Thick pus comes from ureter which is obstructed at thirteen centimetres. Wax bougie negative.

*Indigo-carmin test* (No. 1). Faintest excretion in fifty-eight minutes from right kidney; none from left.

December 23, 1915: Blood urea nitrogen, 18.2 milligrammes; incoagulable nitrogen, 43 milligrammes per 100 cubic centimetres.

X-ray examination shows a large stone filling pelvis of right kidney; a small stone in left kidney, and a larger one in left ureter over the sacro-iliac synchondrosis corresponding to the obstruction in left ureter at 13 centimetres.

Blood pressure: systolic, 100 millimetres; diastolic, 70 millimetres.

December 28, 1915: *Phthalein test* (No. 1). Traces excreted.

December 29, 1915: *Phthalein test* (No. 2). Output, a trace.

December 29, 1915: Left ureterotomy for stone; left nephrotomy for pyonephrosis. Gas and oxygen anæsthesia. Left kidney converted into a large sac.

December 31, 1915: *Phthalein test* (No. 3) on bladder urine, which is almost entirely secretion of right kidney. Total output, 5 per cent.

January 2, 1916: *Phthalein test* (No. 4). Right kidney, total output,  $7\frac{1}{2}$  per cent.

January 4, 1916: *Phthalein test* (No. 5). Right kidney, total output, 6 per cent.; left kidney, trace.

January 11, 1916: *Phthalein test* (No. 6). Output, 5 per cent.

January 17, 1916: *Phthalein test* (No. 7). Output, 19 per cent. in four hours, right kidney.

February 2, 1916: Pyelotomy for right pyonephrosis under gas and oxygen. Very little parenchyma in this kidney.

February 12, 1916: *Phthalein test* (No. 8). Output, 30 per cent. in four hours, right kidney; left kidney drainage a trace.

January 2, 1916, to February 12, 1916: Urea output varied from 0.1 per cent. to 1.2 per cent. concentration in twenty-four hours. Total output of urea varied from a fraction of a gramme to 12 grammes.

February 14, 1916: Uneventful recovery.

*Summary.*—It is evident that in this case of bilateral disease, despite low output, no improvement in function was possible without direct attack on the kidneys. To remove all inhibitory influences, toxic or reflex, as well as to save whatever parenchyma there was in the left kidney, this side was operated upon first. After this operation there was a slight improvement in the output of the other kidney which apparently was doing most, if not all, the excretory work of the patient. Despite the low output, a pyelotomy was successfully done, on the second kidney,

## FUNCTIONAL RENAL TESTS

with marked improvement in total output. In other words, the intrinsic causes of low output being removed, there followed a marked improvement in kidney function.

CASE XVI.—L. H., aged fifty-six years. Admitted November 2, 1915. Discharged January 20, 1916.

*Diagnosis: Bilateral nephrolithiasis.*

In 1901 right nephrolithotomy. In 1912 left nephrolithotomy. Stones have recurred on both sides. Has had repeated attacks of pyelonephritis on both sides. Last attack was very severe, with high temperatures. Following this entered hospital for relief of pain and removal of stones. On admission patient in fair condition, anæmic. Tenderness over both kidneys.

November 3, 1915: *Phthalein test* (No. 1). Output, 5 per cent. Right kidney—Urea, 0.5 per cent.; pus, red blood-cells, albumin heavy trace. Left kidney—Urea, 1.0 per cent.; pus, red blood-cells, albumin heavy trace.

X-rays show very large stones in left kidney; large stone in right kidney.

Blood urea nitrogen, 18.2 milligrammes; incoagulable nitrogen, 27.2 milligrammes per 100 cubic centimetres.

*Indigo-carmin test* (No. 1). In two hours very faint excretion.

Blood pressure: systolic, 120; diastolic, 70.

November 5, 1915: Twenty-four-hour specimen, urea, 0.7 per cent., total 42 ounces.

November 6, 1915: Nephrolithotomy (left kidney), under gas and oxygen.

December 13, 1915: Uneventful recovery. Left kidney is discharging all its urine through wound.

*Phthalein* (right kidney) *test* (No. 2). Only traces excreted.

December 24, 1915: *Phthalein* (right kidney) *test* (No. 3). Traces excreted. Dressings of left kidney well colored with phthalein.

Blood urea nitrogen, 16.1 milligrammes; incoagulable nitrogen, 45.4 milligrammes per 100 cubic centimetres.

Alveolar  $\text{CO}_2$  = 3 per cent.

Patient left the hospital and is to return for a right nephrolithotomy.

February, 1916: Right nephrolithotomy under gas and oxygen; uneventful recovery. Phthalein rose to 30 per cent.

*Summary.*—In this case of bilateral very large stones, there was no chance of restoring or improving the kidney function unless the intrinsic causes of the trouble were removed. Consequently the better organ was first attacked without any uræmic manifestations following

the operation despite the minimal output of test substances. After the operation the function of this organ improved markedly.

CASE XVII.—R. G., aged thirty-two years. Admitted October 8, 1912, and frequently readmitted up to the fall of 1915.

*Diagnosis: Bilateral nephrolithiasis.*

October 12, 1912: Right nephrotomy for calculous pyonephrosis.

November 12, 1912: Right nephrectomy.

September 18, 1914: Anuria due to left calculous pyelonephritis. Left nephrotomy and partial decapsulation for suppurative calculous pyelonephritis.

Wound healed. Patient well for a time. Stones reformed and many were passed. Repeated attacks of mild pyelonephritis.

March 11, 1915: *Phthalein test* (No. 1). Output, 20 per cent. Occasional rises in temperature with left lumbar pains and much pus in urine suggested a subacute pyelonephritis due to calculi (X-ray positive).

Blood urea nitrogen, 19.6 milligrammes; incoagulable nitrogen, 50 milligrammes per 100 cubic centimetres.

March 26, 1915: *Phthalein test* (No. 2). Output, 5 per cent.

March 27, 1915: *Phthalein test* (No. 3). Output, 5 per cent.

March 30, 1915: *Indigo-carmin test* (No. 1). Faint excretion.

April 6, 1915: Blood urea nitrogen, 30.8 milligrammes; incoagulable nitrogen, 47 milligrammes per 100 cubic centimetres.

April 8, 1915: Left kidney markedly enlarged and tender.

April 9, 1915: Extravasation of urine in left side. Area incised and drained (gas and oxygen anaesthesia). Kidney had apparently ruptured through old nephrotomy scar.

April 13, 1915: *Phthalein test* (No. 4). Total output, 5 per cent. The only evidence of uraemia throughout this period was frequently repeated vomiting.

April 19, 1915: *Indigo-carmin test* (No. 2). Appearance in forty-five minutes very faint. An hour later slight increase in concentration, one hour later very faint again and after another hour no color.

May 12, 1915: *Phthalein test* (No. 5). Output, 5 per cent.

June 5, 1915: Patient again developed a fulminating infection of her kidney and a second nephrolithotomy and decapsulation for suppurative calculous pyelonephritis was performed, under spinal anaesthesia.

Recovery from operation without uraemia.

June 16, 1915: *Phthalein test* (No. 6). Output, 6 per cent.

July 23, 1915: It was determined to keep a permanent tube in the kidney sinus, as a safety valve, in case new stones tended to form, as well as to medicate the pelvis.

*Phthalein test* (No. 7). Output, 7 per cent.

## FUNCTIONAL RENAL TESTS

July 26, 1915: *Phthalein test* (No. 8). Output, 20 per cent. in four hours.

August 5, 1915: Discharged relieved.

August 13, 1915: Anuria. Ureter catheter passed to pelvis and purulent urine obtained. Old lumbar incision, which had been allowed to close, was reopened under gas and oxygen and tube drainage reintroduced.

August 17, 1915: Blood urea nitrogen, 130 milligrammes; incoagulable nitrogen, 187 milligrammes per 100 cubic centimetres.

August 18, 1915: *Phthalein test* (No. 9). Less than 5 per cent.

August 20, 1915: Blood urea nitrogen, 30 milligrammes; incoagulable nitrogen, 77 milligrammes per 100 cubic centimetres.

September 28, 1915: *Phthalein test* (No. 10). Only traces.

October 24, 1915: *Phthalein test* (No. 11). Only traces in four hours.

November 19, 1915: Discharged. Patient is up and about.

February 10, 1916: Condition about the same. Has had occasional attacks of colic with fever. Drains through her sinus whenever the ureter gets plugged. Has lost weight and strength.

March, 1916: Third nephrolithotomy, decapsulation and drainage for stone recurrence. Gas and oxygen; uneventful recovery.

June, 1916, patient in better condition than she has been at any time since 1914.

*Summary.*—This extraordinary case shows how a patient with a solitary diseased kidney can stand a whole series of operations on that kidney under spinal anaesthesia, or gas and oxygen, even though the output of the test substances is minimal and the blood retention is increased, without going into a fatal uræmia. Despite the minimal excretion, which temporarily improved after the second nephrolithotomy, this patient has been under observation for ten months without developing fatal uræmia. The cause of her trouble is definitely intrinsic, and only by attacking this directly could improvement of function and prolongation of life be expected.

## CONCLUSIONS

I. Extrinsic causes (usually obstructive in character) may lead to permanent symmetrical renal damage, evidenced by minimal or zero excretion of phthalein and indigo-carmin associated usually with high blood urea and high incoagulable nitrogen blood content. Operation in these cases will be of no permanent benefit, and even the slightest (in one case the passing of a cystoscope) may bring on a fatal uræmia (Group A).

2. Similar extrinsic causes may lead to temporary renal damage evidenced by the same phenomena as under 1. Operation in these cases, particularly after adequate preliminary treatment, will be rarely followed by uræmia (Group B).

3. These two wholly different types of cases can be differentiated by removal of the usual causative factor, *i.e.*, relief of the obstruction, either by use of indwelling catheter, or regular catheterization, or by preliminary cystostomy under local anæsthesia or gas. If the case is of the type under 1, no marked change in the renal output will result, whereas if the case is of the type under 2, the renal output will regularly improve.

4. A similar low combined output may be caused reflexly (inhibitive or toxic) by more or less extensive disease of one kidney, while the other kidney is adequate and improves in its function after removal of its diseased mate, or after relief of the pathological condition in its mate (Group C).

5. A low combined output may also be due to bilateral intrinsic causes<sup>\*</sup> and improvement in these cases is possible only after operative attack on the kidneys, or the kidney, if single, under an anæsthetic which has no injurious effect on the diseased kidney parenchyma and provided no severe wound infection or other septic, etc., complications which overtax this parenchyma develop (Group D).

---

<sup>\*</sup> Unilateral in single kidney cases.



## TRAUMATIC INJURIES OF THE KIDNEY AND URETER \*

BY HENRY G. BUGBEE, M.D.

OF NEW YORK CITY

INSTRUCTOR IN CLINICAL SURGERY IN THE COLLEGE OF PHYSICIANS AND SURGEONS OF COLUMBIA UNIVERSITY

INJURIES of the upper urinary tract are most often subparietal, subcutaneous or subdermal—not associated with external wounds—and are in the nature of contusions, lacerations, and ruptures. Injuries associated with external wounds are generally due to stabbing or shooting, though various other accidents have been recorded.

KIDNEY.—Summaries of cases of traumatic injuries of the kidney have been compiled by Delbet,<sup>1</sup> in 1901, Watson,<sup>2</sup> in 1903, Suter,<sup>3</sup> in 1905, Lardennois,<sup>4</sup> in 1908, and Connell,<sup>5</sup> in 1911, the last-named author adding to previous lists 147 cases, of which he found "either mere mention, or a more or less complete report," thus bringing the number up to 875. Since the appearance of Connell's paper, there seems to have been no exhaustive review of the literature so far as case reports are concerned, though a number of articles on the subject have appeared, recording one or more cases. The two largest single series which have come under my notice are those of Lüken,<sup>6</sup> who, in 1914, reported 47 cases, treated in the Leipzig Clinic (Trendelenburg Director), during the years 1895 to 1911, inclusive, and of Ponomareff,<sup>7</sup> who, in 1914, reported 57 cases, observed during the years 1898 to 1912, inclusive. I have found, dating from the appearance of Connell's contribution, records of 224 additional cases. I do not wish, however, to convey the idea that no other cases have been reported, for the reasons already stated. These, with 8 cases which I shall add, bring the total number of reported cases of traumatic injuries of the kidney up to 1107. This is probably a fairly accurate estimate, inasmuch as it may be considered that the number of cases overlooked is perhaps more than counterbalanced by those, included in the summary, in which the recorded facts leave room for doubt as to the diagnosis.

*Causes of Injury.*—Lardennois<sup>4</sup> divides ruptures of the kidney into three general classes, which apply likewise to injuries other than those usually denominated as rupture: (1) Those due to *direct trauma* (kicks; blows; falls upon stones, beams, bars, etc.; being crushed between two wagons, by wheels, etc.; and other manifestations of direct force applied

\* Read before the American Association of Genito-Urinary Surgeons, May 9, 1916.

over the region of the kidney). (2) Those due to *indirect trauma* (violent horse-back riding; falling on the feet). (3) Those due to *muscular action* (sudden springing backward; heavy lifting; sudden movements in the effort to catch objects or to dodge blows, etc.).

In 45 out of 770 cases reviewed by Lardennois,<sup>4</sup> the cause of rupture was found to be shock or blow upon the anterior abdominal wall, and in only 3 of these were other abdominal organs injured.

The fact that the blow or force does not need to be very severe in order to cause serious injury, even complete rupture, of the kidney, is demonstrated in a number of reported cases. Gargam,<sup>8</sup> for example, in 1881, cited a case in which rupture of the kidney resulted from the individual striking against a table. A similar case, in which the patient struck himself against a counter, was reported by Borzy,<sup>9</sup> in 1900. In Borzy's case hæmatoma was found, with a rupture, large enough for the insertion of a finger, in the lower half of the kidney. It was with difficulty that the cause of the injury was elicited when the patient was seen some time subsequently—the fact being taken to signify the trivial character of the accident.

A case, frequently mentioned, was cited by Voit, in which a woman, while dancing with her husband, who held her very tightly round the waist, felt a severe pain in her right side. Hæmaturia set in at once, was very abundant, and lasted two months, intermittently. At the end of this time the perirenal effusion began to suppurate. Lumbar incision for purposes of drainage revealed the fact that the kidney was ruptured. This case, sometimes mentioned as an illustration of rupture by muscular action, also suggests the presence of some concurrent contributory factor.

The following case, in my series, illustrates the point that relatively slight muscular action may result in injury to the kidney.

CASE I.—J. A., male, thirty-two years old; chauffeur, with negative family and previous personal history. In June, 1914, while bending down and cranking a car, patient felt a sharp pain in the left side of the abdomen, beneath the costal margin, became faint, and had to lie down. After a few minutes he was able to stand, and with assistance to go home. For two weeks he was unable to work as a chauffeur, owing to the pain in the side, when he tried to stand or move about. At the end of this period he did some work, but had to stop work and go to bed again. He then had a constant pain in the left side of the back, and began to run a temperature ranging from 100° in the morning to 103° at night.

Six weeks after the injury I saw the patient, and found on examination a large, firm, tender mass in the left lumbar region,

## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

extending from beneath the costal margin to the crest of the ilium. The mass was slightly movable, and was easily felt anteriorly on bimanual palpation. The urinary examination was negative, as were likewise the cystoscopic examination and ureteral catheterization. The patient's temperature at this time was 103 degrees and the pulse 110. The diagnosis of hæmatoma secondary to laceration of the kidney, the result of muscular violence, was made, and operation advised.

I made a lumbar incision, and, upon reaching the perirenal fat, a large, broken-down hæmatoma was encountered. Nearly a quart of thick pus was evacuated, and a laceration found in the kidney, at the junction of the lower and middle thirds of the organ. The laceration extended down to but not into the kidney pelvis. There was still some oozing from the torn kidney surface. The wound in the kidney was packed with gauze and the lumbar incision closed about it. The patient made an uneventful recovery.

Subsequent analyses of separated urines have shown a functional capacity of the left kidney equal to one-half that of the right.

Here, then, was an extensive laceration of the kidney, due to muscular action of a moderate degree of violence, with extensive hemorrhage, but with no extravasation of urine and no changes in the urinary stream.

FAUNTLEROY,<sup>10</sup> in 1912, reported the case of a robust seaman, twenty-one years old, who had fallen a distance of two feet, while cleaning the forward turret of the ship, striking the left side of the abdomen against the ball attached to the stock of a small anchor which was lashed to the side of the turret. The kidney was exposed by a Mayo incision, whereupon it was found that there was still active hemorrhage, and on both the anterior and the posterior surfaces there was a large rent in the capsule and parenchyma extending, on both surfaces, from the convex border into the hilum. In addition to this, the central part of the viscus was soft and pulpy, rendering it impossible to suture the wounds, and necessitating nephrectomy.

ATKINSON,<sup>11</sup> in 1914, cited the case of a girl, fourteen years old, who, while running after a dog, ran across a fifteen-foot porch, into a light wire netting at the edge of the porch, and fell two feet, into a flower bed of soft earth. Despite the fact that the child could not have acquired a great momentum in the distance covered, severe symptoms immediately supervened, and operation revealed a laceration extending right through the kidney substance, the upper pole being much more severely injured than the lower.

A case similar to the preceding as regards the relatively trivial character of the accident, came under my observation in 1914.

CASE II.—J. W., male, aged six years. Family and previous personal history negative. In May, 1914, patient fell from a park bench, a distance of 2½ feet, striking on his left flank. He fainted, and was carried home. An hour later he passed urine

deeply colored with blood. He complained of pain in the left flank. When seen by a doctor marked tenderness was found in the left kidney region. Ice was applied, and the patient was kept quiet in bed. There was no elevation of temperature, no mass appeared in the side, and the hæmaturia diminished.

Two weeks later, when seen by the writer, the patient had been allowed to get up, and the hæmaturia had returned. At this time the patient presented a palpable left kidney, tender, but not irregular. No mass was felt outside the kidney. Ureteral catheterization showed a profuse left-sided hæmaturia, but otherwise no change in the kidney excretion. Under rest the patient made a complete recovery.

In this case the laceration of the kidney communicated with the pelvis of the organ, yet there was no rupture of the kidney capsule. No hæmatoma formed, and there was no infection.

It is interesting, in connection with the study of cases in which injury to the kidney resulted from very slight force, to note that most of such cases reported are in young adults and children, in some of whom, at least, there is a possibility of a causative factor in some abnormality of the abdominal viscera. The possibility of the persistence of infantile ptosis, as suggested by Aglave,<sup>12</sup> by leaving more of the surface unprotected by the thoracic bulwark, in the opinion of Gibson,<sup>13</sup> may account for some of the cases of renal traumatism in children. The particular vulnerability in childhood has also been ascribed to the minimum deposit of perinephric fat, according to Gibson, and the greater tension of the overlying peritoneum.

In the case cited by Atkinson<sup>11</sup> it was found, upon median sub-umbilical exploratory incision, that about midway between the cæcum and the splenic flexure there was a kink, formed by the lower end having a long mesocolon, allowing a partial volvulus. Just above this kink, and about on the level of the junction of the lower and middle thirds of the injured kidney, there was a transverse tear, about an inch long, into the lumen of the gut. Such cases suggest a line for further inquiry.

Gibson,<sup>13</sup> in four cases of complete rupture of the kidney in children, ranging in age from eight to twelve years, found a similarity in the lesions, which, with the fact that they were the same with different kinds of violence, seemed to him to confirm the theory of "bursting" by hydraulic pressure, as suggested by Küster.<sup>14</sup>

From his review of the literature and the tabulated statistics of 22 cases of rupture of the kidney in children, Gibson believes these injuries to be more common than is generally estimated.

Küster's hydraulic pressure theory, as is well known, was evolved

## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

from experiments which consisted in distending the veins, arteries, and renal pelvis, then applying violence to the surface of the organ. Deep transverse lacerations, extending into the pelvis of the kidney, resulted. From these observations he concluded that the essential element in the production of rupture of the kidney is hydraulic pressure. This pressure, acting through the renal pelvis and blood-vessels, causes bursting of the viscus upon the receipt of a blow. The blow or other force may lead to rupture, whether it be applied directly against the back and ribs over the kidney, or indirectly from the anterior abdominal wall.

The rupture, according to Küster, is usually transverse, and takes place in the interlobular lines of the embryonic kidney. In Gibson's cases, however, the line of rupture was vertical to the long axis of the kidney, at about the junction of the two lower thirds. This would seem to indicate a different line of least resistance, such as Gibson had not seen mentioned in any of the treatises on the subject.

Morris<sup>15</sup> holds that the ribs play an important part in the production of traumatic injuries of the kidney. When the force is applied upon the back or sides it is directly transmitted to the kidney by the impact of the ribs upon this organ. When the force is directed upon the front of the abdomen it is indirectly transmitted, by impact of the ribs, to the kidney. In either case the kidney is driven against the unyielding vertebral column. It is more difficult, however, as Gibson has pointed out, to apply this explanation to those manifestations of indirect violence such as a fall on the feet.

The fact that the preponderance of cases of traumatic injuries of the kidney concern males in the prime of life, as compared with their occurrence in females of any age and in children, would seem to be explained on the basis of the exigencies of active life rather than of any inherent predisposing condition or disease.

The part played by general arteriosclerosis, syphilis, and other affections in predisposing to injury of the kidney by slight degrees of traumatism, has not been thoroughly investigated, so far as I am aware. It is conceded, however, that syphilis, arteriosclerosis, cancer, polycysts, and calculi may render the kidney more susceptible to traumatic injuries.

*Nature of the Injury.*—The injury to the kidney following traumatism of whatever kind may vary from tears of the fatty capsule, localized subcapsular hemorrhage, slight contusion or laceration of the parenchyma, to rupture of the pelvis of the kidney, injuries to the renal blood-vessels, complete rupture, single or multiple, or general pulpification, with or without complicating rupture of the peritoneum or injury to other structures.



Swainson,<sup>16</sup> in 1914, operated upon a child, six years of age, who had fallen down five wooden steps, sustaining a rupture of the kidney into three portions, held together slightly at the pelvis, which was itself torn. Stellate fractures are reported in a number of cases. Rupture, complete and incomplete, may be entirely intracapsular, as in Case II of my series. Rupture of a single or horse-shoe kidney was reported by E. O. Smith<sup>17</sup> in 1915. Twenty-two cases of injury of the renal blood-vessels were collected and reported by Vidakovic<sup>18</sup> in 1913, and one case of injury of the suprarenal capsule was reported by Canestro<sup>19</sup> in 1912. The right kidney is more often injured than the left. Bilateral injuries are rare. Franklin,<sup>20</sup> in 1912, reported a case in which the left kidney was "torn to pieces," and the right presented three transverse tears. The patient was a girl, sixteen years old, who had fallen from a wagon.

Habs<sup>21</sup> expressed the view that in all renal lesions there may be synchronous lesions of the peritoneum, the stomach, the intestines, the liver, and the spleen. If this be true, the aspect of the case would naturally be influenced thereby, and such a possibility should be borne in mind.

The experimental observations of Falcone<sup>22</sup> are interesting in this connection. He experimented upon eight dogs, reducing one kidney to a crushed mass. In the other kidney the results, in the first days after this operation, were extreme congestion, glomerular and interstitial hemorrhages, with oliguria, and the presence of albumin and white and red corpuscles. In the successive days the quantity of urine increased, the color improved, but the albuminuria nearly always persisted, in some cases with cylindruria. Falcone concluded from these observations that, while a strict clinical application to man is not possible—else the 25 per cent. mortality in man given by Legueu<sup>23</sup> would be higher—when any lesion is suspected in the uninjured kidney one should proceed without delay to remove the injured organ, since probably only by this radical means can the life of the patient be saved. These observations are worthy of further study.

*Symptoms.*—Shock, localized pain, tumor from hemorrhage into the perirenal tissues, hæmaturia, and changes in the quantity of urine, are the chief symptoms associated with injury of the kidney. The so-called classic symptoms (shock, pain in the lumbar region, and hæmaturia) are present in widely varying degrees of severity, and cases are recorded which emphasize the fact that all these symptoms may be absent for a varying length of time; also that one or more may be lacking throughout. In a case reported by Sears<sup>24</sup> nothing occurred

## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

for several days to direct attention to the kidney, despite the fact that an injury sufficiently severe to practically pulpify the kidney was found at autopsy. In Fauntleroy's case,<sup>10</sup> mentioned above, the symptoms were meagre. The following may be cited as a typical case, the injury being complete subparietal rupture of the kidney.

CASE III.—The patient was a boy aged fifteen years. His history previous to February 19, 1910, was negative. On this day, while coasting, his sled turned, throwing him violently against an iron post. The blow was received squarely between the ribs and the crest of the ilium. He complained of severe pain in the side, but was examined by a physician, who expressed the opinion that he would be all right in a few days. Two hours after the accident he passed an ounce of bloody urine, and this was repeated an hour later. His condition became alarming, and a second physician was called in, who advised his removal to the hospital.

I saw him nine hours after the receipt of the injury. He was then pale, cold and clammy, covered with sweat; the pupils were dilated; respirations gasping; pulse thready and irregular; temperature 97°. In other words, he was in profound shock. The right side of the abdomen was filled with a rather firm, rounded, slightly movable, tender mass. The remainder of the abdomen was distended, and the right half was tender. The diagnosis of rupture of the right kidney was made. The firmness of the mass indicated a hæmatoma and the absence of intraperitoneal injury.

After expectant treatment for several hours, during which time the patient's condition did not improve, an intravenous saline injection was given, and a rapid posterior exposure of the kidney was made. The kidney was found to be completely ruptured, transversely, the line of fracture involving the renal pelvis and vessels. The loin was filled with blood, urine and clots, which were cleared out. The pedicle was rapidly ligated and the kidney removed. The patient rallied at once, the remaining kidney functionated normally, and the convalescence was uneventful, the patient leaving the hospital at the end of six weeks.

The degree of *shock* present depends upon the amount of hemorrhage; also upon whether the injury to the kidney is complicated by injury of the peritoneum and other organs. It is held by some observers that the fatty capsule of the kidney tends to control the hemorrhage, and consequently influences the degree of shock.

Bloch,<sup>25</sup> in 1914, reported a case in which shock was apparently entirely absent. The patient, a boy of seventeen, walked into the doctor's office with the statement that he had struck his left loin against

the corner of a table, and that shortly thereafter had voided bloody urine. Careful examination revealed no cut, scratch, swelling, or other external indication that he had received an injury. His only symptom was hæmaturia. Exposure of the left kidney, after forty-eight hours of expectant treatment, revealed a large amount of extravasated blood, and a laceration of the kidney on its convexity of about two-thirds of its length, the laceration extending in depth about one-half of the kidney substance.

In some instances the shock is transitory, and failure to elicit a history of this symptom is doubtless sometimes due to this fact, especially if the injury is associated with considerable hemorrhage.

Intense lumbar *pain*, which is one of the characteristic symptoms, is very severe at first, as a rule increasing in intensity during the first hour after the injury, probably as the result of the consequent and increasing effusion of blood, and the infiltration of urine into the perirenal tissues. Not infrequently the pain, severe at first, decreases or entirely disappears. In some cases of severe kidney lesions pain is never a manifest symptom. In the case reported by Sears<sup>24</sup> pain in the lumbar region was never present.

An important characteristic, noted by Habs, where hæmaturia is not present, is that pain radiates down from the lumbar region to the scrotum, the penis, and even to the thigh, due, presumably, to pressure from the effused blood on the nerves supplying this region. In one of the cases reported by Habs this was the only characteristic symptom.

The presence of a *tumor* in the renal region in cases of traumatic injury of the kidney depends, in many cases, upon the extent and localization of the hemorrhage. It may be due, as in cases reported by Perriol and Bosquette,<sup>26</sup> Mincer,<sup>27</sup> Wildbolz,<sup>28</sup> and others, to hydro-nephrosis or pseudohydronephrosis.

The fact that the tumor may be intermittently apparent, and that this state of affairs may extend through a number of years following traumatism in the loin, with presumptive injury to the kidney, is illustrated in the following case:

CASE IV.—F. V. T., male, aged fifty years. Thirteen years before admission to St. Luke's Hospital (April, 1916), the patient, while lifting a hog, was kicked in the left side. After this he had pain in this region, followed by the appearance of a "lump," which increased in size. He went to a hospital, where he was treated expectantly for three weeks. At the end of that time, according to his history, he felt something give way, whereupon he voided material which was very dark in color. The lump then

## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

decreased in size. Since that time the mass has been intermittently larger and smaller. When it decreases in size the urinary output is increased. He has had occasional attacks of pain in the lumbar region, sometimes in the nature of an ache, at others it has been sharp and knife-like. There has been no hæmaturia since he left the hospital, three weeks after the injury. Following a recent attack of grippe, he experienced pain and tenderness in the left side, and was then admitted to the hospital.

Examination revealed the presence of a tumor in the left kidney region. Upon cystoscopic examination the bladder was found to be normal, except for slight congestion. Ureteral catheterization yielded concentrated, clear urine from the right side; from the left side, the urine was dark and cloudy, and flowed more freely upon pressure on the tumor mass, the mass, meanwhile, diminishing in size. The urine from this side contained much pus, and showed very little functional capacity of the left kidney. The diagnosis of laceration of the left kidney, due to the blow in the loin, was made, with the development of a hæmatoma, the breaking down of the hæmatoma, and the subsequent degeneration of the kidney. The patient refused operation.

*Hæmaturia* has been considered by Kocher and a number of other observers as the cardinal symptom of renal lesions. Vielcker,<sup>29</sup> on the other hand, considers this an uncertain sign, not so reliable as the detection of retroperitoneal tumor, ecchymosis in the inguinal or scrotal region, or the indications of peritoneal tear. The danger of depending upon this sign, or rather the danger of being misled by its absence, is emphasized by numerous cases.

STONEY,<sup>30</sup> in 1910, reported a case in which a man, twenty-eight years of age, was thrown from a bicycle, alighting on his shoulder. He was unconscious for a few moments, then went home. He remained in bed for two weeks, during which time he complained of pain in the right side. Not until he got up again did he notice blood in the urine. He then went to a hospital, where he was under observation for three weeks. The urine now contained a quantity of blood, which the Luys segregator showed to come from the right kidney. At operation it was found that the kidney was almost torn in two at the hilum, the lower half being in a state of pulp.

In a case reported by Ehrenpreis,<sup>31</sup> of complete rupture of the kidney in a man of twenty-eight years, resulting from a fall from the seat of a carriage, hæmaturia did not appear until the tenth day after the accident. In the case reported by Sears,<sup>32</sup> the urine, while high-colored and of high specific gravity, and decidedly acid, presented no macroscopic evidence of blood until the fifth or sixth day. The quantity of blood then increased rapidly, and clots filled the bladder to such an extent that a more or less firm tumor could be easily outlined in the lower abdomen. In this case, it will be remembered, autopsy showed a pulplified condition of the kidney.

In Case IV of my series, hæmaturia was present only once, three weeks after the injury, during a history of thirteen years.

The absence of hæmaturia in a case reported by Greensfelder<sup>32</sup> was accounted for by the presence of a clot in the pelvis of the kidney which prevented the urine or blood and urine from passing down the ureter.

Johnson<sup>33</sup> calls special attention to cases of traumatic renal affections in which the hæmaturia is intermittent, and describes a parenchymatous hæmatoma, the capsule of the kidney being intact. In the following case from my series hemorrhages into the cortex of the injured kidney were demonstrated.

CASE V.—H. L., female, aged twenty years. Two weeks before admission to the hospital patient fell out of bed, giving her body a sharp twist. Since that time she has had pain in the left lumbar region. Four days after the fall she had a chill, fever, vomiting, slight hæmaturia, and continued severe pain in the left kidney region. Tenderness of the lower pole of the kidney, which was palpable, was elicited. No tumor was demonstrable, and the kidney was apparently not enlarged. Urethra, bladder and ureter normal. Upon ureteral catheterization, urine from the right kidney was found to be acid, there was transitory albuminuria; leucocytes few; function normal. Urine from the left kidney was neutral, with transitory albuminuria, few leucocytes and red blood-cells, some epithelial cells; function diminished. X-ray examination revealed a definite kidney outline, of regular contour, with an increased density of the kidney shadow, particularly of the lower pole.

The symptoms of pain and tenderness diminished after a week of rest in bed. The patient left the hospital, and it has not been possible to follow the after-history.

In this case, as in many others which do not come to operation, it is not possible to make an absolute diagnosis, but the findings—history of injury, localized symptoms, tenderness of the kidney, hæmaturia, diminution of function, increased density of kidney shadow—seemed to be sufficient to warrant the diagnosis of intrarenal hemorrhage, with slight laceration of the pelvis and no break in the capsule of the kidney.

Many of the cases reported in the literature emphasize the fact that very slight symptoms do not preclude the possibility of severe or even fatal hemorrhage; and that the intensity of the hæmaturia is not always in relation to the gravity of the lesion, as pointed out by Legueu,<sup>23</sup> Cathelin,<sup>34</sup> and others. It is well known that very slight injury may cause severe hemorrhages in cases in which the injured kidney is the seat of polycystic formations, of malignant neoplasms, and of calculi.



## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

On the other hand, it is not to be overlooked that a perirenal or renal hæmatoma may become organized. Gyselynck<sup>35</sup> cites such a case in which, a year and a half after the injury, the kidney was found to be the seat of a tumor the size of the fist, situated on the posterior surface. The tumor was in reality a cystic pouch formed from the tissue of the kidney, which had become enlarged. It contained liquid blood and a quantity of coagulum that appeared to constitute veritable tissue. The following case from my series is an illustration of this possible outcome:

CASE VI.—H. D., male, aged twenty-nine years. While playing foot-ball, in 1909, the patient was accidentally kicked in the left side of the abdomen, just below the ribs. This area was tender for several months, and he had an occasional attack of dull, aching pain over the left kidney, which persisted, at intervals, until 1913, when I first saw him. He had had no urinary symptoms. Upon examination a moderate increase in the size of the left kidney was detected, the lower pole of which was easily palpable. The kidney was tender on bimanual palpation. A radiograph showed an irregular area (not a definite shadow), in the lower pole of this kidney, of varying and greater density. Ureteral catheterization showed slight decrease in the function of this as compared with the right kidney; otherwise, was normal. Combined radiographic and cystoscopic examination gave no irregularity in the outline of the pelvis, and the dense area (thickened kidney) was not in immediate contact with the pelvic margin. No operation was performed, but the findings indicated an organized hæmatoma in the lower pole of the kidney, caused by the injury. The hæmatoma did not communicate with the pelvis of the kidney, hence no urinary symptoms were present.

*Changes in the quantity of urine* (oliguria, anuria, polyuria) are perhaps more variable than the so-called cardinal signs of traumatic injury of the kidney. With a history of trauma of such nature as to probably involve the kidney, changes in the quantity of the urinary output are to be taken as significant of injury to the upper urinary tract.

*Complications and remote results* are always to be reckoned with as possibilities in connection with traumatic injuries of the kidney. Secondary hemorrhage, suppuration, pseudohæmatonephrosis, hydronephrosis, intraperitoneal hemorrhage, nephritis, cysts, calculi, and perhaps malignant neoplasms may be associated with or may follow as a result of traumatic injuries of the kidney. Wildbolz<sup>38</sup> collected 17 cases of traumatic hydronephrosis. Köhler<sup>36</sup> reported a case of floating kidney resulting from trauma; renal calculi following injury to the

kidney have been reported by Casper<sup>87</sup> and others, and instances of the development of malignant neoplasms in the kidney subsequent to the injury have been reported by Theilhaber,<sup>38</sup> Beneke and Namba,<sup>39</sup> and Tscherning<sup>40</sup> among others. In the following cases of my series movable kidney was a result of injury:

CASE VII.—J. C., male, aged fifty-one years. Previous history excludes the kidney from consideration. Two months before admission to the hospital, in an automobile accident, patient was struck in the left side by a mud-guard. He was unconscious immediately after the accident, but experienced no other trouble until two months later, when he began to have an aching and persistent pain in the left side of the back, which was relieved by lying down. These attacks were followed by the passing of large quantities of urine. There had been no change in the appearance of the urine. Examination revealed palpable, movable left kidney; right kidney apparently normal. Cystoscopic examination and ureteral catheterization showed, when combined with X-ray examination, a prolapsed kidney, but no other pathological condition. The symptoms were relieved by applying an abdominal belt and pad for the left kidney.

CASE VIII.—P. W. H., male, aged thirty-six years. Eleven years before he came under my care, patient fell from a fire escape, striking the right side of the abdomen, midway between the ribs and the crest of the ilium. Hæmaturia followed the accident, and lasted four days. Since the accident he has had more or less constant dull pain just below the right costal margin. He has had no further urinary symptoms, and has been in good general health. Upon examination, a small movable mass was palpable under the right costal margin, undoubtedly the kidney. Cystoscopic examination and urethral catheterization revealed a deficient and movable right kidney, but the urine contained no pathological elements. A pyelogram showed an obliteration of the lower calyx, and an indefinite, faint, irregular shadow, involving the lower pole of the right kidney, with no changes in the size or outline of the renal shadow—presumably a cicatrix resulting from laceration at the time of the injury, eleven years before.

The pyelogram in this case is similar to one taken recently in which the kidney, twelve years previously, had been split and a section removed.

*Diagnosis.*—One or more of the typical symptoms will be elicited, if carefully sought for, in the majority of cases, though, as we have seen, apparent exceptions have been recorded. With the history of a blow on the side or back, shock, pain, tumor, and hæmaturia, the diagnosis

## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

is plain. In the absence of tumor, hæmaturia will probably be present, and the investigation of this will reveal the cause.

Not all cases, however, as we have seen, are typical, presenting the classic or cardinal symptoms in such degree and sequence as to lead to a positive diagnosis of injury to the kidney. The difficulties often increase as the time between the accident and the examination lengthens.

When the diagnosis cannot be conclusively established from the clinical signs, one or more of the various aids to diagnosis should be employed. Cystoscopy, ureteral catheterization, microscopic examination of the urine, pyelography, and radiography are to be considered in this connection.

Pyelography has been advocated by Luckett and Friedman<sup>41</sup> as a means whereby positive information may be obtained, and by which one may determine how much laceration has occurred to the kidney substance, whether it is an intracapsular injury, or whether the capsule has been torn through, the determining factor being the dissemination of collargol (injected through the ureter) within the kidney substance or outside of it, as shown by the radiograph. This leads to conclusions as to whether surgical interference will be imperative without waiting for secondary symptoms as an indication for such interference.

Florence and Ducuing<sup>42</sup> have suggested, in connection with a case in which the diagnosis was difficult, the diagnostic value of exploratory puncture of the cul-de-sac of Douglas, by way of the perineum.

Heitz-Boyer<sup>43</sup> made the diagnosis of traumatic nephritis by means of examination with experimental polyuria and the ascertaining of the urea normal of Auerbard.

In some cases a positive diagnosis, especially with reference to the extent of the injury, can be made only by means of exploratory laparotomy or lumbotomy. Resort to this more radical method of diagnosis should be prompt in the face of urgent symptoms, the exact origin of which cannot otherwise be determined.

*Treatment.*—After reviewing the opinions of a number of experienced observers Lüken<sup>6</sup> concludes that there is no uniformity in the matter of treatment of traumatic injuries of the kidney, except that all decide on operation where life is in danger from primary hemorrhage or infection arising at the wound focus. My own review of the literature leads to virtually the same conclusion. However, whether the treatment be expectant, conservative surgical (exploration, drainage, suture, or partial excision), or radical surgical (nephrectomy), each case must be considered individually. It goes without saying that it is desirable, wherever this is possible, to leave the patient with two functionat-

ing kidneys rather than one, and where this cannot be done, to conserve as much as possible of healthy kidney tissue. Early and positive diagnosis is the most potent factor in the attainment of this end. While it is true, as many writers have stated, and as at least two cases of my series (Cases VI and VIII) seem to indicate, that spontaneous cure can and does take place, too many chances should not be taken with Dame Nature, who is apt to be rather whimsical in the application of her boasted healing power. Whether expectant treatment or conservative methods be employed, we should take care that we are not subjecting the patient to the possibility or the probability of the subsequent destruction of the kidney, in part or in the whole, from infection of the kidney substance itself or of a hæmatoma.

URETER.—MORRIS,<sup>44</sup> in 1884, stated that he saw no reason for considering the subject of traumatic injuries of the ureter apart from the kidney, because, as he said, "in the very few cases on record the rupture of the ureter was quite close to the renal pelvis, and it was neither practicable nor requisite from the point of view of treatment to distinguish between subcutaneous rupture of the renal pelvis and subcutaneous rupture of the ureter." He further stated that only three cases of penetrating wounds of the ureter had been published, at least one of which was doubtful. He concluded "that the diagnosis, symptoms, sequelæ, and treatment of injured ureter in no way differed from those of ruptured or wounded kidney." His estimate of the subject at that time was based upon the records of 13 cases of subcutaneous rupture of the ureter and 3 cases of penetrating wounds.

From the appearance of his earlier communication up to 1901, Morris<sup>15</sup> found 8 additional cases purporting to be subcutaneous injuries of the ureter. These cases, however, were not all cases of injury of the ureter proper, and they did not give him grounds for changing his opinion expressed in 1884. Because of the growing importance attached to the surgery of the ureter he considered the subject separately in the 1901 edition of his book. Of the 24 cases reviewed by him at that time, he considered only 12 as injuries of the ureter proper.

Blauel,<sup>45</sup> in 1906, found only 12 cases of subcutaneous injuries of the ureter. Since 1906 I have been able to locate only 7 cases, including the one given below.<sup>45-51</sup>

CASE IX.—Male, forty-six years of age. The patient came under my observation in November, 1907, with the following history: Three years before he had fallen from a ladder, striking on the left side of the abdomen, the force of the blow coming unduly between the last rib and the crest of the ilium. The pain



## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

was severe, and radiated to the left groin and testicle. He vomited. He noticed no blood in the urine, but there was a diminution in the amount passed. Several days later a swelling appeared in the left side of the abdomen. This had never disappeared, and had become larger. He had had almost constant pain in the side; no chills, fever, or extreme tenderness. His general health had failed, and he had been under medical care, with no relief.

Upon admission to the hospital, physical examination was negative except for a smooth, tense, slightly tender mass, somewhat movable, in the left side of the abdomen. Examination of the urine was negative. The tumor was exposed through an oblique kidney incision. It was found to be a hydronephrotic kidney, of three distinct lobulations. The thin cyst wall (thinned-out kidney parenchyma) was smooth on the surface. The whole mass extended from the crest of the ilium up under the ribs. It was adherent to the peritoneum and adjacent structures, and was freed with much difficulty. In freeing the lower pole of the mass it was ruptured, allowing the escape of eighteen ounces of thin, odorless, yellow fluid. The ureter was exposed, lying to the inner side of the mass. Two inches from the pelvis of the kidney the ureter presented a dense stricture. The stricture was fibrous in character, and prevented the passage of fluid from the kidney. There was no kink in the ureter. The kidney was removed. There was no evidence of injury to the kidney, of a calculus, or of a growth. The trouble, it is fair to assume, dated from the injury; the history, and the appearance at operation, clearly indicated a traumatic stricture of the ureter, with consequent hydronephrosis. The right kidney functionated perfectly throughout. The patient was under my care for six weeks, and was discharged healed and cured. He has been well since.

This case may be said to be typical, in so far as cases of traumatic injury of the ureter alone are ever so, for it is generally conceded that there are no definitely characteristic symptoms in these cases. Pain and tenderness over the loin or abdomen, the presence of a tumor, and the history of injury may suggest rupture of the ureter, but they are likewise suggestive of injury of the kidney. Hæmaturia may be present in slight degree, it may be entirely absent, or it may be transient. The pain may subside after a time, and not appear again until it becomes associated with the presence of the tumor, the manifestation of which may be noted within a few days or not for several years, according to some of the writers on the subject.

There seems to be no dependable method whereby injured ureter



with extravasation may be differentiated from injured renal pelvis with extravasation. Inasmuch as the treatment is the same, this lack of differential diagnosis is of little moment.

Dumitresco,<sup>46</sup> in reporting a case of traumatic rupture of the ureter, considers the diagnosis as twofold: (a) The diagnosis properly so-called, depending upon whether the patient has been seen directly after the accident or not until several days after; (b) differential diagnosis, from: (1) simple contusion in the region of the ureter; (2) rupture of the kidney and kidney pelvis; (3) rupture of the bladder.

Immediate catheterization and examination of the urine is important in establishing the diagnosis; cystoscopy will show the side injured; and ureteral catheterization will reveal the condition of the opposite side.

The management of cases of ureteral injury, like those of injury of the kidney, calls for exploratory incision if the symptoms do not promptly subside upon expectant treatment. When the exact conditions are thus determined, the treatment, of course, must be applied according to the needs of the individual case. This may consist of drainage, of suture, or repair by whatever method is preferred, of anastomosis, or of nephrectomy.

#### CONCLUSIONS

From a review of the literature concerning traumatic injuries of the upper urinary tract and of the available reported cases, it may be fairly concluded:

(1) That the small number of recorded cases of traumatic injuries to the kidney and the ureter, as compared with traumatic injuries in general, may be accounted for in part by the failure to make a correct diagnosis, and in part by the fact that many cases are dismissed as cured following a period of rest and expectant treatment, with temporary amelioration of symptoms.

(2) That a careful "follow up" system would doubtless throw a different aspect over many of the cases treated expectantly and dismissed as cured, as with 3 of my series.

(3) That, in all probability, many cases of the vague symptom-complex, neurasthenia, might be cleared up by a more careful study of the history and the symptoms in relation to the possibility of traumatic injuries of the urinary system, especially the kidney.

(4) That in no case, where any of the evidence directs attention to this part of the body, should too much dependence be placed in the cardinal symptoms, as to their absence or their presence.

(5) That prompt and painstaking diagnosis, and the application of

## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

treatment in accordance with the exigencies of each case, will tend to lessen the mortality and the remote results of the injury, and will lead to the conservation of functioning kidney tissue in many cases in which ultimate nephrectomy would otherwise be necessary.

### BIBLIOGRAPHY

- <sup>1</sup> Delbet: De la contusion rénale et de son traitement. *Ann. d. mal. d. org. génito-urin.*, Paris, 1901, xix, 669 and 805.
- <sup>2</sup> Watson, Francis S.: Subparietal Injuries of the Kidney. *Boston Med. and Surg. Jour.*, July 9 and 16, 1903.
- <sup>3</sup> Suter, F. A.: Über subkutane Nierenverletzungen, insbesondere über traumatische paranephritische Ergüsse und traumatische Uronephrosen. *Beitr. z. klin. Chir.*, Tübing., 1905, xlvii, 349-402.
- <sup>4</sup> Lardennois, Georges: Étude sur les contusions, déchirures et ruptures du rein. Paris, 1908.
- <sup>5</sup> Connell, F. G.: Primary Suture of Subparietal Rupture of the Kidney. *Surg., Gynec. and Obst.*, Chicago, 1911, xii, 196 (Report of Western Surgical Assoc.); also *Jour. Am. Med. Assoc.*, 1911, lvi, 875.
- <sup>6</sup> Lüken, E. A.: Über 47 an der Leipziger klinik von 1895-1911 beobachtete und behandelte Fälle von subkutaner Nierenruptur. *Deutsche Ztschr. f. Chir.*, Leipz., 1914, cxxix, 242.
- <sup>7</sup> Ponomareff, S.: Über die Behandlung der subkutanen Nierenrupturen auf Grund eines materials von 57 Fällen. (Aus den Jahren 1898-1912.) *Beitr. z. klin. Chir.*, Tübing., 1914, lxxxix, 682-699; also, *Russk. Vrach. S. Peterb.*, 1908, vii, 1644-1646.
- <sup>8</sup> Gargam: Contusion du rein. Thèse de Paris, 1881.
- <sup>9</sup> Borzy: Cited in Moineu's Thèse de Paris, 1900—Contusion at déchirure du rein. *Observation 8*, p. 108.
- <sup>10</sup> Fauntleroy, A. M.: Rupture of the Left Kidney; Nephrectomy. *U. S. Nav. Med. Bull.*, Washington, 1912, vi, 404.
- <sup>11</sup> Atkinson, J. L.: A Case of Rupture of the Kidney from Slight Trauma. *Brit. Med. Jour.*, 1914, ii, 468.
- <sup>12</sup> Aglave, M. P.: Note sur la situation du rein chez le jeune enfant par rapport à la crete iliaque et reflexions sur l'ectopie renale. *Bull. et mém. de la Soc. Anat. de Paris*, vol. lxxxv, 6s., 1910, 595.
- <sup>13</sup> Gibson, C. L.: Rupture of the Kidney in Children. *N. Y. State Jour. Med.*, 1912, xii, 326-330; also *Am. Jour. Med. Sc.*, 1912, clxiii, 649-656.
- <sup>14</sup> Küster: Zur Entstehung der subcutanen Nierenzerreissungen und der Wanderniere. *Arch. f. klin. Chir.*, Berl., 1895, i, 676.
- <sup>15</sup> Morris, Henry: *Surgical Disease of the Kidney and Ureter*. London, 1901.
- <sup>16</sup> Swainson: Nephrectomy for Ruptured Kidney. *Med. Press and Circ.*, London, 1914, n. s. xcvii, 65.
- <sup>17</sup> Smith, E. O.: Traumatic Rupture of Horse-shoe Kidney, Operation, Recovery. *Lancet-Clinic, Cincinnati*, 1915, cxiv, 333.
- <sup>18</sup> Vidakovic, C.: Über die Verletzungen der Nierengefässe. *Virchow's Arch. f. path. Anat.*, etc., Berl., 1913, ccxiii, 554.
- <sup>19</sup> Canestro, C.: Tramatism delle capsule surrenali. *Folia clin. chim. e micros.*, Salsomaggiore, 1912-1914, iv, 341-360.

# HENRY G. BUGBEE

- <sup>20</sup> Franklin, A. L.: Rupture of Both Kidneys. *Am. Jour. Surg.*, 1906, xx, 309.
- <sup>21</sup> Habs: Over nierverwondingen. *Med. Weekbl., Amst.*, 1905-1906, xii, 434-438; also *Mench. Med. Wehnschr.*, 1905, vol. lii, 602-605.
- <sup>22</sup> Falcone, R.: Sulle lesioni di un rene consecutive ad un trauma sul rene opposto, ricerche sperimentali. *Folia urolog.*, Leipz., 1912-1913, vii, 26.
- <sup>23</sup> Legueu, F.: Rupture rénale. *Clinique*, Paris, 1912, vii, 251; also *Bull. et mém. Soc. de Chir. de Paris*, 1912, n. s., xxxviii, 318.
- <sup>24</sup> Sears, M. H.: Serious Disorganizing Injury to the Right Kidney with Very Slight Primary Symptoms. *Denver Med. Times*, 1913-1914, xxxiii, 8.
- <sup>25</sup> Bloch, O. E.: Kidney Injuries. *Urol. and Cutan. Rev.*, St. Louis, 1914, xviii, 169.
- <sup>26</sup> Perriol and Bosquette: Un cas d'uronephrose consecutive a un traumatisme (effort brusque). *Le Dauphine med.*, 1910, vol. xxxiv, 202.
- <sup>27</sup> Mincer: Hydronephrosis Due to Trauma. *Urolog. Jahresbericht*, 1911, 116.
- <sup>28</sup> Wildbolz, H.: Traumatische Hydronephrose geheilt durch Pyloneostomie. *Ztschr. f. Urol.*, Berlin u. Leipzig, 1911, v, 672-677.
- <sup>29</sup> Vielcker, F.: Über die Indikationstellung zu operationen Eingreifen bei subkutanen Nierenverletzungen. *Beitr. z. klin. Chir.*, Tübing., 1911, lxxii, 604.
- <sup>30</sup> Stoney, R. Atkinson: Rupture of Kidney by Trauma—Nephrectomy. *Lancet*, London, May 21, 1910, 1413.
- <sup>31</sup> Ehrenpreis: Rupture complète du rein. *Bull. et mém. Soc. anat. de Paris*, 1912, lxxxviii, 239; also *Jour. de méd. de Paris*, 1913, 2s, xxv, 657.
- <sup>32</sup> Greensfelder, L. A.: Ruptured Kidney. *Internat. Jour. Surg.*, 1914, xxvii, 163.
- <sup>33</sup> Johnson, A. B.: Diagnostic Errors in Surgical Renal Affections. *Medical Record*, 1910, lxxvii, 603.
- <sup>34</sup> Cathelin, F.: Les Traumatismes du rein (à propos de dix observations de contusion rénale guérie sans intervention). *Paris chirurg.*, 1912, iv, 888-892; also *Rev. prat. d. mal. org. gén.-urin.*, Paris, 1913, x, 1-13.
- <sup>35</sup> Gyselynck: Un cas d'hématome organisé du rein. *Jour. de chir. et ann. Soc. belge de chir.*, Brux., 1910, x, 137-140.
- <sup>36</sup> Köhler, F.: Lungentrauma und traumatische Wanderniere, ein eigenartiger Begutachtungsfall. *Aertzl. Sachvest-Zeit.*, 1909, vol. xv, 349.
- <sup>37</sup> Casper: Nierensteine als Folge einer Nierenverletzung. *Berl. klin. Wehnschr.*, 1910, xix.
- <sup>38</sup> Theilhaber: Der Zusammenhang von stumpfen traumen mit der Eintstehung von Carcinomen und Sarkomen. *Deut. Zeit. f. Chir.*, vol. cx, 77.
- <sup>39</sup> Beneke and Namba: Ein Fall von traumatisch bedingtem Nierentumor, mit Bemerkungen zur Pathologie des infiltruerenden Nierenkrebses. *Virchow's Arch. f. path. Anat.*, etc., Berl., 1911, ccii, 463-480.
- <sup>40</sup> Techerning, E. A.: The Importance in the Insurance Business of Trauma as a Cause of Malignant Tumors. *Ugesk. f. Laeger*, Kjobenh., 1911, lxxiii, 581-592. *Abst. in Jour. Am. Med. Assoc.*, June 10, 1911, 1770.
- <sup>41</sup> Lockett, W. H., and Friedman, L.: Pyelography in the Diagnosis of Traumatic Injury of the Kidney. *ANNALS OF SURGERY*, 1914, lx, 729; also *Am. Jour. Obst.*, 1914, lxix, 857.
- <sup>42</sup> Florence and Ducuing: Contusion du rein: hematoperitoine; guerison spontanee; valeur diagnostique de la ponction exploratrice du cul-de-sac de Douglas. *Bull. et mém. Soc. de chir. de Paris*, 1913, n. s., xxxviii, 645.
- <sup>43</sup> Heitz-Boyer: Un cas de néphrite traumatique démontré à l'aide des nouvelles méthodes d'exploration. *Jour. d'urol. méd. et chir.*, Paris, 1912, ii, 549.

## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

- "Morris, Henry: *Surgical Diseases of the Kidney*. London, 1884.
- "Blauel, C.: *Über subkutane Ureterverletzungen*. *Beitr. z. klin. Chir.*, Tübing., 1906, i, 28.
- "Dumitresco, D., and Buia, J.: *Un cas de rupture traumatique de l'uretere; quelque mots sur le diagnostic des ruptures ureterales traumatiques*. *Gaz. d. hôp.*, Paris, 1914, lxxxvii, 1190; also *Med. Press and Circ.*, London, 1915, n. s., xcix, 494.
- "Rowlands, R. P.: *Case of Ruptured Ureter Due to Trivial Injury*. *Med. Press and Circ.*, London, 1909, lxxxvii, 404.
- "Zaaijer, J. H.: *Intraperitoneale ureterwonding*. *Nederl. Tijdschr. v. Geneesk.*, Amst., 1911, i, 249-259.
- "Abbe, R., and Martin, W.: *Rupture of the Ureter, Followed by Extravasation of Urine and Suppurative Nephritis; Nephrectomy*. *ANNALS OF SURGERY*, 1912, iv, 468-470.
- "Vance, F. E.: *Traumatic Injury of the Ureter*. *Railway Surg. Jour.*, Chicago, 1910-1911, xvii, 402.
- "Legueu, F.: *Rupture traumatique complete de l'uretere*. *Bull. et mém. Soc. de chir. de Paris*, 1914, n. s., xl, 106; 148.

## ADDITIONAL REFERENCES

- Mayer, A. J., and Nelken, A.: *Subparietal Rupture of Solitary Kidney*. *Jour. Am. Med. Assoc.*, 1911, lvii, 1262.
- Pilcher, P. M.: *Injuries to the Kidneys, with End Results*. Year-book, Pilcher Hospital, 1911, i, 117; also *Surg., Gyn. and Obst.*, Chicago, xii, 109; *Am. Jour. Surg.*, New York, 1911, xxv, 81.
- Steiner, P.: *Ein durch Operation geheilter Fall von subkutaner Nierenruptur*. *Pest. med.-chir.*, Presse, Budapest, 1910, xlvi, 182.
- Keuper, E.: *Über Nierenverletzungen*. *Beitr. z. klin. Chir.*, Tübing., 1911, lxii, 748.
- Limoncelli, G.: *Contusione e rottura renale in rene cistico*. *Gazz. internaz. di med.*, Napoli, 1910, xiii, 1282.
- Esau: *Subcutane Zeireissung der rechten Niere mit Abscedierung und Duodenalfistelbildung*. *Med. Klin. Berl.*, 1911, vii, 1538.
- Soboleff, I. A.: *Stab-wound of the Kidney*. *Russk. Vrach.*, S.-Peterb., 1911, x.
- Sayer, André: *Contribution à l'étude de la nephrite traumatique*. Lyon, 1911.
- Batut, L.: *Des traumatismes du rein et de leurs suites*. *Bull. Soc. med.-chir. de la Drôme, etc.*, Valence, 1911, xii, 231.
- Michelson, F.: *Zur Frage der traumatischen Nierenrupturen*. *Arch. f. klin. Chir.*, Berlin, 1911, xcvi, 663.
- Thelen, G.: *Über einseitige Nierenerkrankungen nach Unfallverletzungen*. *Verhandl. d. deutsch. Gesselsch. f. Urol.*, Wien., 1911, iii, Berl. u. Leipz., 1912, 147.
- Silverberg, M.: *Case of Rupture of the Kidney*. *Pacific Med. Jour.*, San Francisco, 1911, liv, 600.
- Davis, B. B.: *Subparietal Injuries of the Kidneys*. *West. Med. Rev.*, Omaha, 1911, xvi, 456.
- Mitchell, A. R.: *Injuries of the Kidneys in Railway Accidents*. *Railway Surg. Jour.*, Chicago, 1910-1911, xvii, 283.

- Kessell, G.: Kidney Injuries. *Railway Surg. Jour.*, Chicago, 1911-1912, xviii, 429.
- Clark, H. H.: Case of Traumatic Rupture of Kidney. *Railway Surg. Jour.*, Chicago, 1911-1912, xviii, 427.
- Morison, Rutherford: A Clinical Lecture on Abdominal Emergencies; Intraperitoneal Hemorrhage. *Clin. Jour.*, London, 1911, xxxviii, 182.
- Pauchet, V.: Les ruptures du rein. *Clinique*, Paris, 1912, vii, 725.
- Stanley, E. G.: Subcutaneous Rupture of the Kidney; Intraperitoneal Hemorrhage; Expectant Treatment; Recovery. *Lancet*, London, 1912, ii, 757.
- Martin, A.: Lacerated Kidney, Urinous Empyema, Operation, Recovery. *New Zealand Med. Jour.*, Wellington, 1912-1913, xi, 157.
- Scholl, J. H.: Subparietal Rupture of the Kidney; Operation; Ultimate Result. *N. Am. Jour. Homeop.*, New York, 1912, lx, 219.
- Strine, H. F.: Lacerated Left Kidney with Severe Hemorrhage; Nephrectomy. *U. S. Nav. Med. Bull.*, Washington, 1912, vi, 243.
- Rand, I. W.: Multiple Rupture of the Kidney by External Violence. *Med. Times*, New York, 1912, xl, 191.
- Adams, A.: A Case of Ruptured Kidney. *Lancet*, London, 1912, i, 861.
- Beall, F. C.: Subcutaneous Rupture of the Kidney. *Medical Record*, 1913, lxxxiii, 64.
- Rhyne, A. W.: Conservative Treatment in a Case of Ruptured Kidney with Successful Recovery. *Miss. Med. Monthly*, 1911-1912, xvi, 174.
- Goberman, A. V.: Subcutaneous Subscapular Rupture of the Kidneys. *Khirurg. Arkh. Velyaminova, S.-Peterb.*, 1912, xxviii, 936.
- Roznatovski, D. N.: Subcutaneous Crushing of a Neoplastic Kidney. *Khirurgia, Mosk.*, 1912, xxxii, 382.
- Lenormant, C.: Quelques points du diagnostic et du traitement des ruptures traumatiques du rein. *Progrès méd.*, Paris, 1912, 3s., xxviii, 452.
- Sejournet and Pardoux: Rupture traumatique du rein: néphrectomie d'urgence: guérison. *Bull. et mém. de Paris*, 1912, lxxvii, 120.
- Marix: Les conséquences patronales dans les traumatismes des reins. *Gaz. hebdom. d. sc. méd. de Bordeaux*, 1912, xxxiii, 357.
- Le Moniet: Rupture traumatique du rein gauche; hématurie prolongée; suture du rein. (Rapp. de F. Legueu.) *Bull. et mém. Soc. de chir. de Paris*, 1912, n. s., xxxviii, 318.
- Jeannel: apropos d'une observation de rupture du rein, importance diagnostique de l'hématurie; avenir des reins traumatismes; valeur sociale d'un rein. *Arch. med. de Toulouse*, 1912, xix, 89.
- Le Jemtel: Déchirure du rein avec hématuries tardives; néphrectomie; guérison. (Rapp. de Legueu.) *Bull. et mem. Soc. de chir. de Paris*, 1912, n. s., xxxviii, 358.
- Batut, L.: Des contusions et ruptures du rein. *Rev. internat. de méd et de chir.*, Paris, 1912, xxiii, 1.
- Chausoff, M. A.: Subcutaneous Injury of the Kidneys. *Kazan. Med. Jour.*, 1912, xii, 39.
- Solownow, P. D.: Zwei Falle von Stich-Schnittwunden der Niere. *Ztschr. f. Urol., Berl. u. Leipz.*, 1912, vi, 131.
- Barkeley, A. H.: Subparietal Rupture of the Kidney with Report of Cases. *Ky. Med. Jour.*, 1912-1913, xi, 474; also *Lancet-Clinic*, 1913, cix, 475.



## TRAUMATIC INJURIES OF THE KIDNEY AND URETER

- Ruotte: Traumatismes du rein. Soc. de méd. mil. franc. Bull., Paris, 1913, vii, 213.
- Toussaint, H.: Quel doit être le pronostic de la contusion des reins? Rev. gén. de clin. et de therap., Paris, 1913, xxvii, 390.
- Bergasse: Déchirures du rein, intervention précoce. Soc. de méd. mil. franc. Bull., Paris, 1913, vii, 5.
- Bories, Hippolyte: Des indications opératoires dans les ruptures traumatiques du rein. Paris, 1911.
- Cotte, G.: Contusion de rein droit du mésentère. Lyon méd., 1913, cxx, 18.
- Oudard: Traumatismes du rein. Soc. de méd. mil. franc. Bull., Paris, 1913, vii, 451.
- Boland, F. K.: Traumatic Rupture of the Kidney; Report of Three Cases; Two Nephrectomies. South. Med. Jour., Nashville, 1913, vi, 669.
- Perimoff, V. A.: Subcutaneous Rupture of the Kidney. Kazan. Med. Jour., 1913, xiii, 55.
- Clark, F. H.: Trauma of the Kidney. Railway Surg. Jour., Chicago, 1913-1914, xx, 329.
- Edington, G. H.: Laceration of Kidney; Nephrectomy. Glasgow Med. Jour., 1914, lxxxii, 219.
- Tucker, H. M.: Rupture of the Kidney from External Violence; Report of a Case; Operation. Charlotte Med. Jour., 1914, lxx, 95.
- Hartshorn, W. E.: Trauma to the Kidney Resulting in Nephrectomy; Report of Two Cases. Boston Med. and Surg. Jour., 1914, clxxi, 935.
- Pearson, J. M.: Subparietal Rupture of the Kidney. Arizona Med. Jour., 1913-1914, ii, 12.
- Leriche: Arrachement traumatique avec torsion du pedicle rénal, volculus du rein; néphrectomie, guérison. Lyon méd., 1914, cxxii, 75.
- Lataste, R.: Un cas de rupture du rein gauche, avec broiement partiel et arrachement de la rate saine. Jour. de med. de Bordeaux, 1914, xlv, 389.
- de Smeth, J.: Déchirure traumatique de rein, nephrectomie. Jour. méd. de Brux., 1914, xix, 155.
- Jakimiak, B.: Rupture of the Right Kidney. Med. i. Kron. lek., Warszawa, 1914, xlix, 347.
- Lewenstern, E.: Stab-wounds of the Kidney. Przegl. chir. i. ginek., Warszawa, 1914, x, 129.
- Barth, N.: Ruptura Renis Norsk. mag. f. Laegevidensk., Kristiana, 1915, 5 R. xiii, 1010.
- Borchgrevink, O. C.: Et tilfaelde av ruptura renis. Kristiania kirurg. for. forh., 1915, 51.
- Le Fur, R.: Blessure du rein et de l'uretère gauche par éclat d'obus; néphrectomie; guérison. Paris chir., 1915, vii, 31.
- Witherspoon, L. G.: Subscapular Injuries to the Kidney. Bull. El Pasco Co. Med. Soc., 1915, vii, 24.
- Barbat, J. H.: Ureteral Defect Repaired with Loop of Intestine; Report of a Case. Calif. State Med. Jour., San Francisco, 1915, xiii, 70.

## OS CALCIS FRACTURE \*

BY FREDERIC J. COTTON, M.D.

OF BOSTON

IN presenting this paper to the Association, I am moved by both pride and chagrin. Eight years ago I published a paper on this subject, which I have reread recently; it contains so exactly what I believe to-day that I am embarrassed. Either I was then and am now entirely wrong, or else the profession continues to be entirely wrong now, after due warning.

For one thing seems certain: outside the staff of my own hospital, no one has paid the least attention. I'm going to do it again, and try to do it better.

In the first place, the lesion itself has not been understood—the crushing and spreading character of the damage; it is not a clean-cut break. The X-ray shows only a confusion of interrupted lines that mean nothing. Cabot and Binney and others have tried to formulate and classify these fractures. This is about as useful as classifying cracks in a walnut, after the nut-cracker is through with it! The heel-bone is mashed down, and there are all sorts of lines to be found. This is well enough illustrated in these plates (Fig. 1).

Be it said in passing that we have no concern with cases of avulsion of a fragment of bone, through pull on the Achilles tendon, a different lesion entirely, so rare that I have personal knowledge of but three cases, and none at all in the hundred odd that have come to my direct attention.

Our class to be considered now are the cases in which the patient lands on his heel and mashes it down. As it mashes down, obviously the rear end of the calcis is pushed up a bit, more or less, in one case and the other; the bone is decreased in its vertical depth (Figs. 2 and 13); also (and more important, as shall presently be shown) its lateral diameter is always increased, and often greatly increased. This increase is more particularly due to a bulging *outward* under the external malleolus (Fig. 3). The specimen shown in this plate serves to show why this is so (Fig. 4). The late Dr. Louis Wilson and I got hold of it, when we first were working on os calcis fractures. It was in no way unlike the average case, save that infection, through a slough, led to amputation; hence the specimen. I know of no other fresh specimen studied out.

---

\* Read before the American Surgical Association, May 11, 1916.

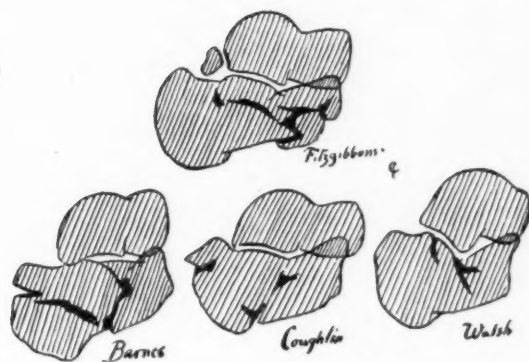


FIG. 1.—Sketches from X-rays in author's collection—fracture of os calcis of various types or lack of type. The upper figure shows fracture of the "apophysis" at the back, also.

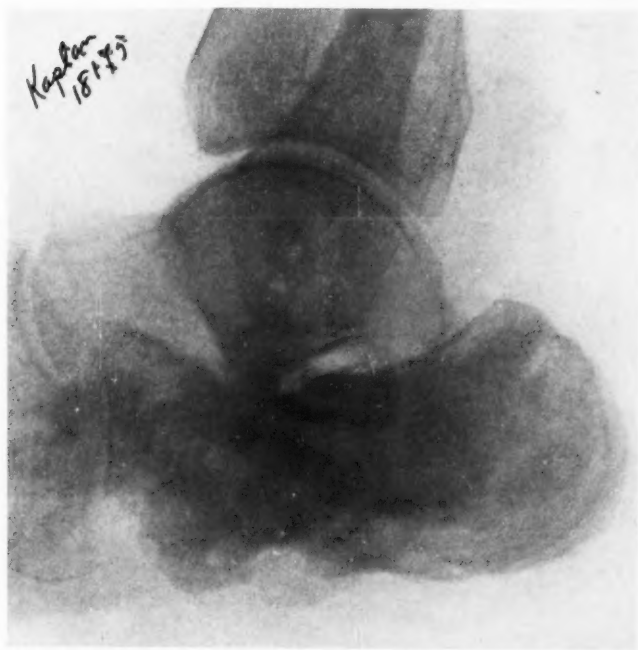


FIG. 2.—The vertical diameter of the bone is notably decreased. Skiagraph of a healed fracture shows also, anteriorly, a deeply projecting spur that must give troublesome pressure in the sole of the foot.

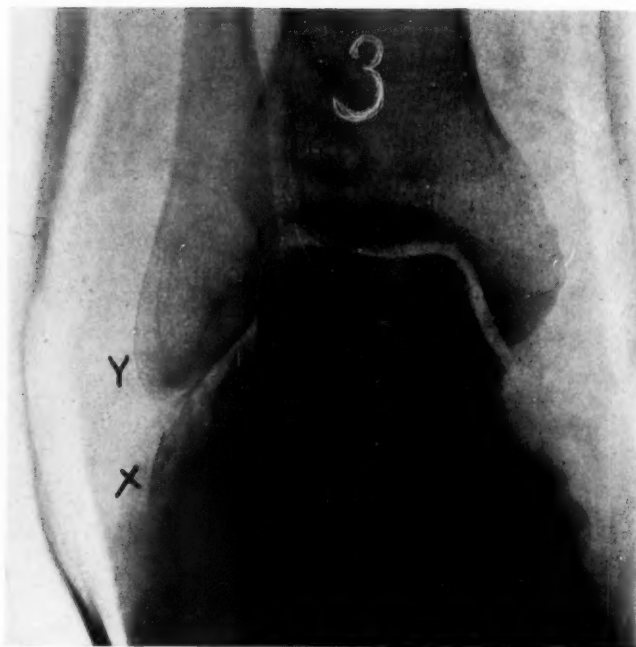


FIG. 3.—Shows the projection of outwardly displaced bone fragments close up under the external malleolus. The point *X* is as far out as the malleolus, *Y*, instead of one-half to three-quarters inch deeper in. This distortion is very evident on palpation.

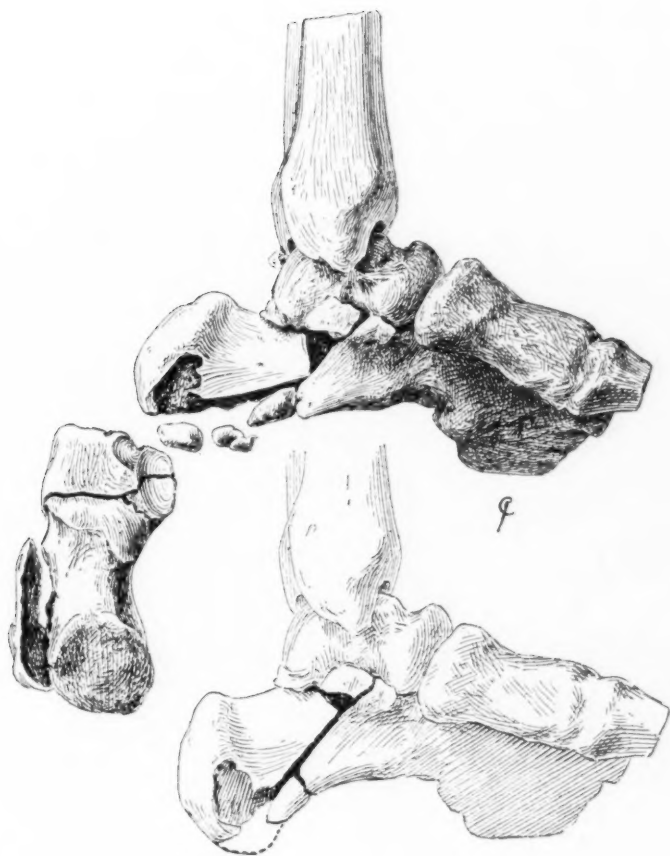


FIG. 4.—Drawings from a specimen of fresh fracture of the os calcis from the author's collection. This was originally a simple fracture of the os calcis of the ordinary type; a skin slough developed, with subsequent sepsis of bone, necessitating amputation. The upper sketch shows the bones as they appeared after maceration; some bone splinters were missing. The os calcis, as a whole, was much displaced upward and outward; the lower sketch shows a reconstruction of the bone, showing fracture-lines; there was irregular splintering in the region of the inner tuberosity, and a fracture-line running through the sustentaculum; the sketch to the left shows the os calcis from above, the last-named fracture-line appears, splitting the sustentaculum; another fracture-like branching from it entirely separates the back half of the sustentaculum; an irregular fracture-line separates the thick cortical plate of the outer side of the bone for a considerable distance. It is not believed that there is anything typical about this fracture-line, as will presently be shown; the X-rays seem to show all sorts of irregular, complicated lines of fracture. I believe, however, that the damage in this particular case is not more than in the cases we are in the habit of seeing.



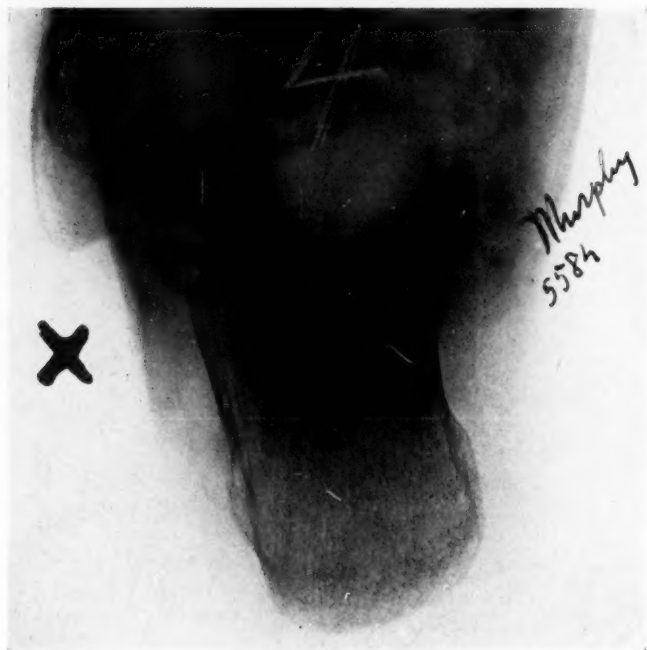


FIG. 5.—View of normal os calcis, seen looking down from behind—plate under the sole of the foot.  
X is the outer side.

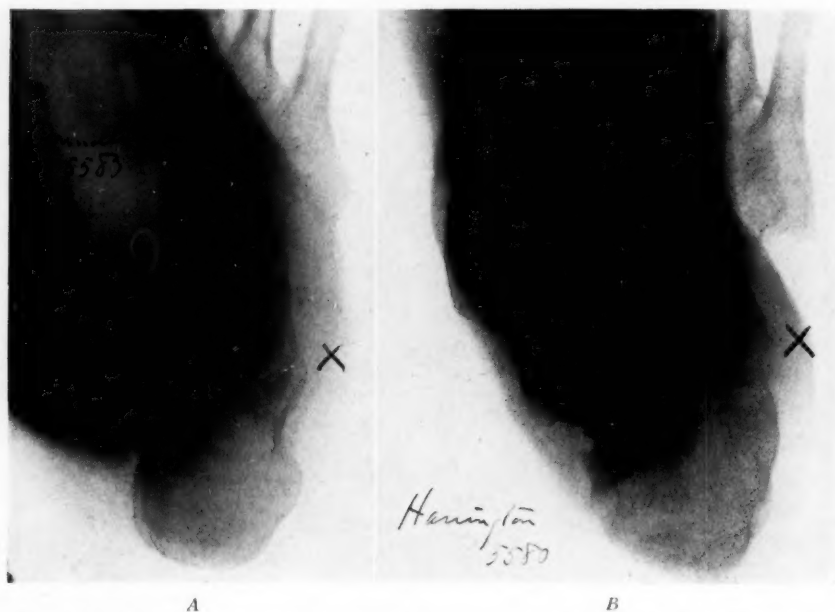


FIG. 6.—Like view of two old crippled cases of calcis fracture. Note the bulge in each cut. X, on the outer side, and, in B especially, the great total broadening of the heel bone.

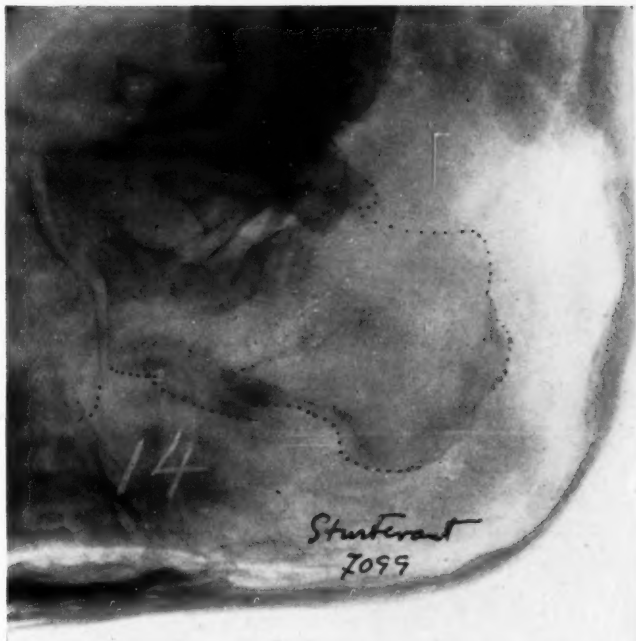


FIG. 7.—After reduction. A case with marked deformity at the start (X-rays taken lost). Shows, after reduction, both general bone outline and joint relations not far from normal. This man recovered nearly all his lateral motion and obtained an excellent result.



FIG. 8.—Recent case. Note decreased depth of bone at the front end, irregular spur formation beginning about the splinter that thrusts downward into the heel, and especially the distortion of the calcaneo-astragaloid joint from displacement along the fracture-line that runs into the front end of the joint. See Fig. 9.



FIG. 9.—Distortion of same joint as Fig. 8, by displacement of fragments.

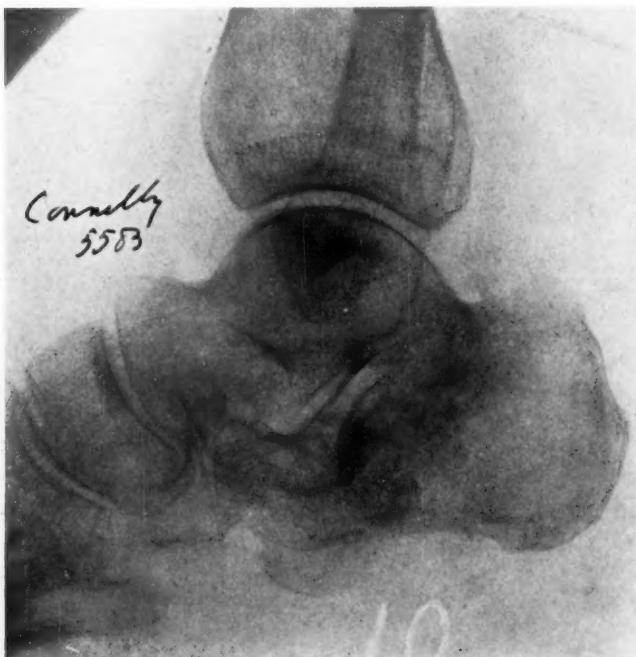


FIG. 10.—Old case. Note decreased vertical diameter of the forward end of the bone. Note also the fragment projecting into the sole, well forward (see Fig. 3). Also, note the posterior calcaneo-astragaloid joint, while perhaps not actually broken into, is so distorted as to be useless as a joint. In fact, this patient had no lateral mobility of the foot. Same case as Fig. 7, A.

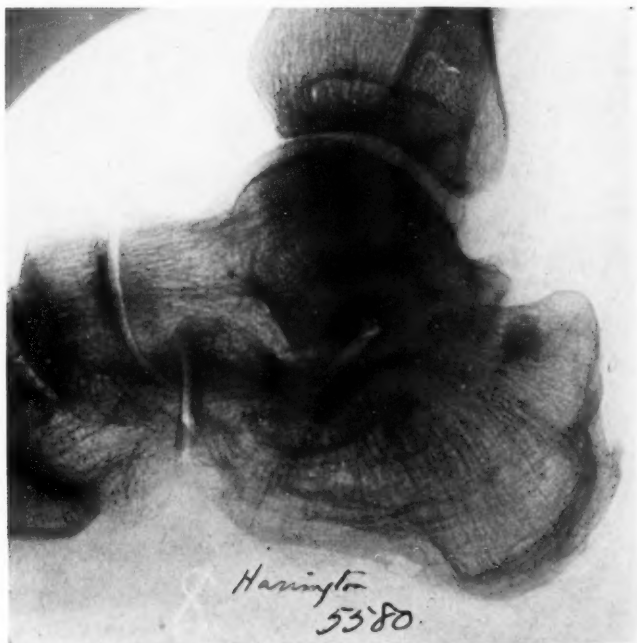


FIG. 11.—Old case, crippled. Note the short heel, short anteroposteriorly, and the shortening of the available joint surface on the calcis side of the posterior calcaneo-astragaloid joint.

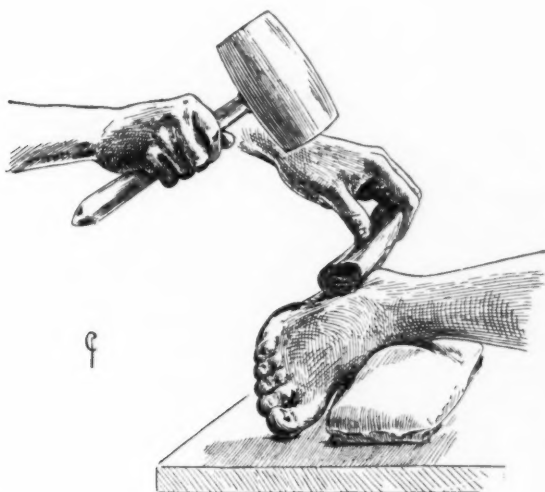


FIG. 12.—Treatment by impact. The foot is laid on a sand-bag, a felt pad held to protect the outer side of the os calcis, which is then impacted by blows from the mallet. This impaction is used only after careful correction of position.



FIG. 13.—Before correction. Note the involvement of the posterior joint; also loss of vertical depth.



FIG. 14.—Same case as Fig. 13, after satisfactory correction and inpaction.



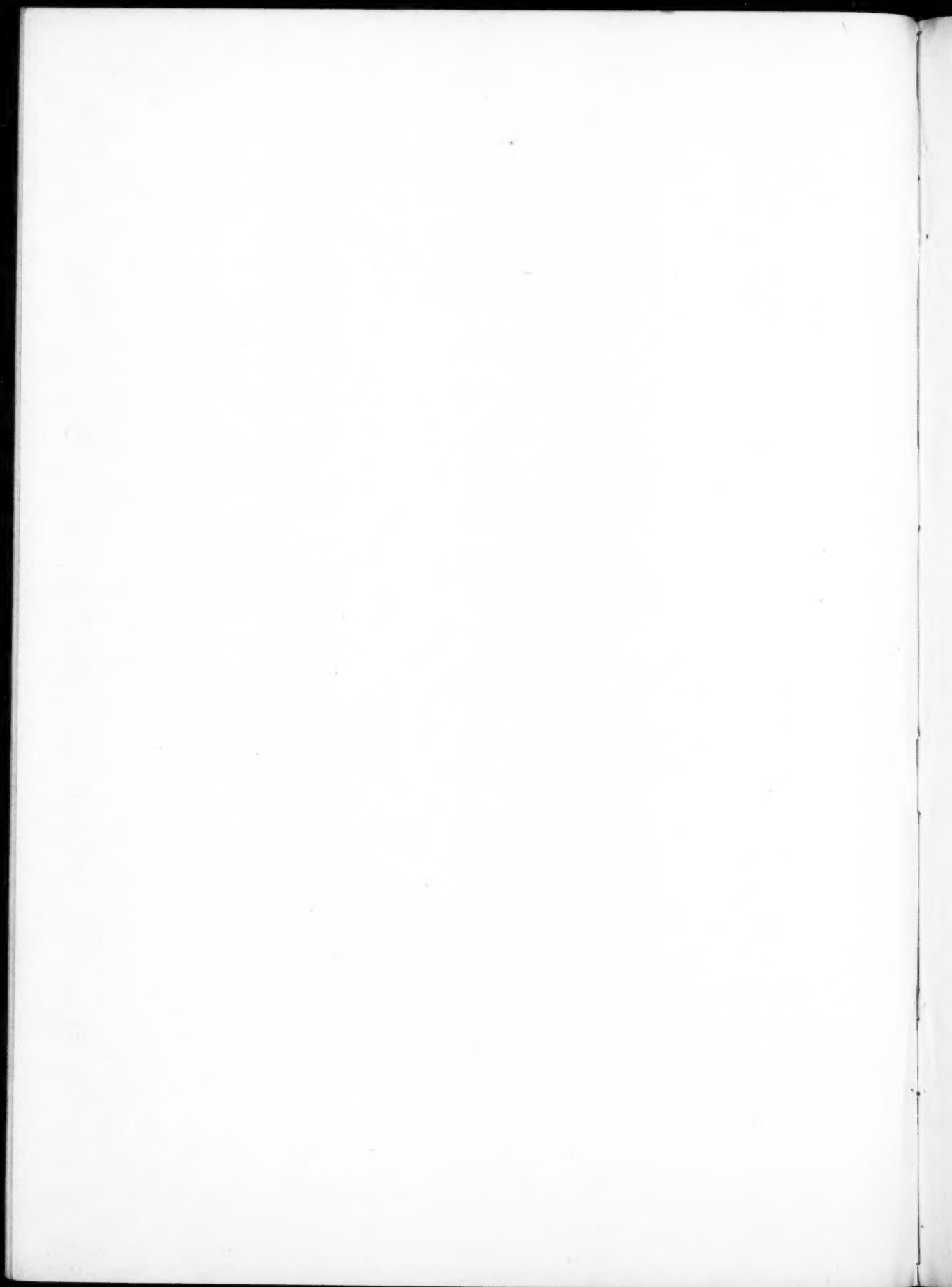
FIG. 15.



FIG. 16.



FIGS. 15 and 16.—Before and after reduction. FIG. 15 shows not only deformity but joint distortion as well. FIG. 16 (taken through the plaster and not clear) shows obvious improvement in both respects.



## OS CALCIS FRACTURE

You will see that there are not only irregular fissures through the spongy bone (a number of them) but also a splitting away of a compact plate on the outer side, which is necessarily displaced outward in greater or less degree. This plate, more compact than most of the bone, carries on it the peroneal tubercle, so-called, and the peroneal tendon sheath, in which the tendons play about the pulley arrangement, of which the tubercle is a part. All this whole arrangement is pushed outward with, and in front of, the external plate of the bone. The plates here shown give an idea of this apparently constant displacement (Figs. 5, 6 and 7).

So constant is this feature that I always expect it; have always, save in two cases, found unmistakable bony thickening at this point; have had no hesitation, when it was present, in making the diagnosis on this point alone, and have failed to confirm the diagnosis in but one out of many cases.

There is one other nearly constant factor—the interference with the joints between the astragalus and calcis; particularly with the posterior calcaneo-astragaloid joint. It may be directly involved, as in the dissected specimen (Fig. 4, and in Figs. 8, 9 and 13), or it may simply have its range of sliding motion shortened, or its alignment thrown out by the displacement of fragments, without the joint being broken open (Figs. 10 and 11).

In either case, it pretty surely goes out of commission more or less completely, as an effective mechanism. This is important, for R. W. Lovett and I showed long ago that it is almost purely between astragalus and calcis that the movements we call pronation and supination occur.

With the joints between os calcis and astragalus gone, pro- and supination disappears, and this is precisely what we nearly always find in os calcis fractures; lateral motion gone—up and down movement preserved.

These then are the features that are nearly constant: (a) Pushing up of the heel; (b) broadening of the bone, mainly outward; (c) interference with lateral mobility.

Now we all know that the usual treatment of os calcis fractures (even when not treated for sprain) is to put them up in plaster and trust to obtain the good results called for in all respectable text-books. What kind of results do we get? Wilson and I concluded in 1908, from a study of 22 cases found in an attempt to "round-up" 84 cases treated at the hospital, that at least half the cases (probably more) had some serious permanent disability; not always enough to prevent some work, but serious. I do not think that this statement is overdrawn. Latterly I have had referred to me, for late examination, 14 cases of os calcis

FREDERIC J. COTTON

fracture, varying from eight weeks to two years after the fracture. They run as follows:

CASE I.—J. A., aged fifty-six; examined at 6 months; much thickening and tenderness; lateral motion lost; totally disabled.

CASE II.—M. J. C., aged sixty-four; examined at 3 months; refused reduction after accident; lateral thickening; tenderness on outer side; short heel; relatively little loss of motion; entirely disabled. Re-examined at 6½ months; better; slow and clumsy; totally disabled.

CASE III.—J. F. D., aged thirty-eight; examined at 5 months. As he stands, the external malleolus is in contact with the calcis; heel broad and flat; very little lateral motion; can walk a half hour, then has to quit; disabled.

CASE IV.—J. G., aged forty-four; examined at 17 months; typical deformity; not extreme; little lateral motion; disability mainly from contact of fibula with calcis; has tried plates, etc.; has much pain and disability. At 2 years 3 months after injury he reports that he is no better, despite exercises, etc.

CASE V.—C. H., aged forty-two; examined at 3½ months; typical deformity; not extreme; up and down motion normal; lateral motion fair; pain entirely on outer side; still disabled; may have some disability but promises a useful foot.

CASE VI.—J. T. L., aged forty-eight; examined at 3 months; much broadening; little displacement of the heel; lateral motions fair; now crippled but probably going to have a useful foot.

CASE VII.—G. J. J., middle aged; examination at 4 months; almost no displacement; disability mainly from the rare factor of spastic contracture of the peroneals; totally disabled but disability probably remediable.

CASE VIII.—H. L., aged thirty-seven; examined after two years; operated on for total disability at the Massachusetts General Hospital, where some bone was removed. Has loss of lateral motion; some thickening and much tenderness on outer side; totally disabled.

CASE IX.—D. M., aged twenty-five; examination at 9 months; fracture of os calcis, right and left. Shows usual deformity in both feet; loss of lateral motion in both feet; much thickening, externally, especially on the left. Can walk for half an hour only; it is very stiff and sore in the morning; still improving very slowly; good for nothing after nine months, and unlikely ever to go back to labor again, though he may improve.

CASE X.—B. C., aged thirty-eight; examined at 2½ months; broadening of heel, well marked; external thickening; up and down motions normal; lateral motions entirely gone. Re-examined

## OS CALCIS FRACTURE

at 3½ months; shows no return of motion; much pain at outer side on walking; entirely disabled; prospects certainly very poor.

CASE XI.—J. B., aged twenty-seven; examined at 2 months; treated as a sprain; great thickening on outer side; total displacement small; motions fair; gets about fairly well; promises to get a useful foot, but probably some trouble from the massive thickening under the external malleolus.

CASE XII.—J. J. S., aged thirty (about); examined after 13 months; thickening present, especially on outer side; up and down motion normal; lateral motion entirely gone; is wearing a plate; gets about with considerable discomfort and not handily; entirely disabled for active fire duty.

CASE XIII.—V. S., middle aged; examined after 10 months; typical deformity; also had a fracture above the ankle; well reduced and united; has tendo achillis contracture as well as total loss of lateral motion. A perfectly useless limb, but with the disability not entirely due to os calcis fracture.

CASE XIV.—C. W., aged twenty-six; examined at 4 months; type deformity; not extreme; considerable loss of lateral motion; up and down movements normal; total disability mainly due to pain on the outer side from contact of the fibula with the greatly thickened calcis. Later I cleared away much of the superfluous bone and stretched the foot into pro- and supination, with almost entire relief of symptoms.

Out of fourteen, none fit to work, when seen, and but three that looked at all promising. A pretty poor showing, when we remember that insurance companies nearly always call for examinations if a man is not on the job in two or three months; so these are probably pretty near an average run of cases.

Besides this series, Dr. Francis Henderson has been trying for months past to track down cases treated at the City Hospital within the last four years. Those of you who have followed the laborer in a big city, in his kaleidoscopic flittings and disappearances, will not be surprised at his indifferent success. Some cases have been found, however, as follows:

CASE XV.—L. B., aged fifty; examined at 3 months; was in hospital and had some manipulation; now shows limitation of all motions; lateral motion entirely lost; has a limp and much pain; is, as yet, entirely disabled.

CASE XVI.—G. P., aged forty-five; examined at 18 months; taken to hospital but would not remain. Shows general thickening about the heel, especially to outer side; lateral motions



entirely gone; up and down motion fair; gets about with an extreme limp and much pain; entirely disabled.

CASE XVII.—D. D. D., aged fifty-four; examined at 7 months; fracture never treated. Shows much limitation of flexion and extension; lateral motions entirely lost; all attempts at motion very painful; has not been able to walk at all on this foot since the accident; X-ray shows the type deformity.

CASE XVIII.—W. C. D., aged fifty-eight; examined 2½ years after; had had no reduction; unable to walk for 9 months; still has a bad limp; lateral motions gone; other motions poor; walks with a stick; practically crippled.

CASE XIX.—A. J., aged thirty-eight; examined after 20 months; much deformity of the heel; arch gone; all motions practically gone; walks with a limp, using a stick; disabled.

CASE XX.—A. D., aged fifty-four; examined after 2½ years; original X-ray shows not very severe displacement. After 2½ years he still limps; shows a great deal of thickening under the external malleolus with some tenderness there; up and down motion fair; lateral motion entirely gone; a good deal of pain; has serious disability but manages to work as a painter.

CASE XXI.—J. M., aged eighteen; examined 2 years after accident; was on crutches 9 months; since then he has walked with a limp and has a great deal of pain in the morning; shows general thickening; lateral motions entirely lost; up and down motion not good; works as a painter despite his disability.

The foregoing cases were untreated or treated only by manipulation and plaster. Those that follow had some real attempt made to correct conditions. The City Hospital staff have been taking os calcis cases seriously enough of late to do something, or have the house surgeon do something.

CASE XXII.—J. J. H., aged forty-four; examined 3 years later; was unable to walk for 8 months; now walks with a limp; there is much thickening under the external malleolus; up and down motions good; lateral motions gone; complains of much pain; unable to stand for any time; completely disabled. (This case had only a hammer impaction done.)

CASE XXIII.—J. R., aged thirty-five; examined 2 years after; had hammer impaction done under ether; began to walk at 15 weeks; has marked restriction of lateral motion; has a very slight limp; is working as engine house fireman; disability slight.

CASE XXIV.—J. R., aged thirty-nine; examined after 2 years and 10 months; had some sort of reduction done and comparison of original X-rays before and after shows marked improvement.

## OS CALCIS FRACTURE

Shows much restriction of lateral motion; up and down motion fair; shows a good deal of thickening; has a considerable limp but works as striker on a coal team; disability slight.

CASE XXV.—D. M. G., aged fifty; examined after three years; "reduction under ether"; noted as having shown a marked flattening; went to work after 13 months; did some work for a year; shows broadening and thickening; lateral motion gone; up and down motion poor; has to use a stick to walk any distance; entirely disabled. (No impaction done in this case.)

CASE XXVI.—S. S., aged twenty-four; examined after three years; said to have been "partially reduced"; shows only moderate thickening but lateral motions are gone; flexion and extension perfect; has a good deal of pain and lameness in the morning; works as a sign painter; disability not great.

CASE XXVII.—M. S., aged forty; examined after two years; was reduced by the house surgeon after my method; original X-ray shows much crushing; has a great deal of thickening; a good deal of loss of lateral motion; limps and says he has a great deal of pain when he has been on his feet all day; disability considerable.

CASE XXVIII.—J. R., aged forty; examined  $2\frac{1}{2}$  years later; reduced according to my method; returned to work in 11 weeks as a carpenter but had trouble for 6 months. Now shows all motions practically perfect; no considerable deformity; walks well and has no pain; at work; perfect result. (Original X-ray shows displacement not extreme; joint not involved.)

CASE XXIX.—D. H.; double fracture; reduced my way; six weeks later getting around pretty well. Investigation  $2\frac{1}{2}$  years later found he had died. (Immediate result of reduction good.)

CASE XXX.—G. M., aged fifty-six; examined 3 years later; was reduced by my method; noted as a case with much thickening externally; lame for 7 months. Now shows slight thickening; a little limitation of lateral motion; has no pain; is back at work in Navy Yard; perfect result.

With these should go private cases:

CASE XXXI.—A man of forty-five for whom I did an impaction last winter, who has now a practically perfect foot.

CASE XXXII.—A friend of mine, a doctor, on whom I did the first impaction, with a perfect foot.

CASE XXXIII.—A case seen for Dr. Emil Geist last year, in which, despite obvious deformity, everlasting massage and exercises brought about very good function.

There is no time here to speak of results of operative treatment on these cases; late intervention, mine or others'. Such operations would rarely be necessary were the cases properly treated at the start.

Now, imperfect as the series is, it covers an end-result investigation of 55 cases, out of original lists of 153; reduced for error to 144 cases, with real data on 55.

Now it is perfectly evident, from the cases cited, that

First, results without more treatment than the traditional plaster are appallingly bad.

Second, with some pains taken (some attempt at reduction) the results are better; sometimes even excellent.

Therefore, we should try to do something: reduce wholly if we can; partly at worst.

My method—or really the method the late Louis Wilson and I worked out together—is as follows:

(1) Loosen up the fracture by manipulation.

(2) Pull the heel down. We used to put a sound through from side to in front of the heel-cord, and pull down; latterly I use ice-tongs as easier to handle and affording a better grip.

(3) Free the joint motion between astragalus and calcis.

(4) Push in the displaced bone under the external malleolus; this narrows and shapes the whole bone. We do it by slowly striking with a big mallet on the outer side of the foot; padding with felt to take the blow; supporting the inner side of the foot on a sand-bag. This impacts, and, owing to the fact that the outer plate is firm, the impaction is usually fairly solid.

(5) We put the foot up in plaster; not at a right angle but with the heel-cord slack; also we avoid direct pressure on the heel.

It is well after the impaction to test again as to the presence of lateral motion. If the impaction has impaired it, work the joints loose again and re-impact. This is rarely needed, however.

I have done this impaction many times; have never failed to get improved position and have usually succeeded in entirely abolishing the abnormal prominence below the external malleolus, and in restoring the lateral motion and in getting a serviceable impaction. Bringing the heel down where it belongs does not always work out so well, but is less important (Figs. 14-16).

Handicapped by poor records and the extreme difficulty in tracing the shifting artisans of big cities, I can give you no real presentation of end-results achieved, though I hope to later on.

What I would say now is that os calcis results are too bad to put up with, as they run, and that the method of treatment presented is, so far as I know, the only proposal that is even logical.

It is logical; it is feasible; it seems to work and I think it deserves further trial.

TRANSACTIONS  
OF THE  
PHILADELPHIA ACADEMY OF SURGERY

*Stated Meeting, held May 8, 1916*

The President, DR. CHARLES H. FRAZIER, in the Chair

EXOPHTHALMIC GOITRE

DR. ALBERT J. OCHSNER, of Chicago, read by invitation a paper with the above title, for which see page 385.

THE SURGICAL TREATMENT OF GOITRE

DR. MILES F. PORTER, of Fort Wayne, Ind., read by invitation a paper with the above title, for which see page 395.

DR. GRANVILLE T. MATLACK, of Wilkes-Barre, said that in relation to the treatment of exophthalmic goitre it should be kept in mind that this disease is one in which distinct remissions may be expected, irrespective of treatment. This remission in some cases is very marked and lasts many times for several weeks. The patient may express herself as being well, put on weight, and gain in strength, and then the symptoms recur. If any form of treatment was being used at this time, it would naturally get the credit for the improvement.

The mortality records following operations for exophthalmic goitre have improved not because the operation has become any easier to perform, but because more consideration is given to what the patient can have done with reasonable safety; when to do it, how much to do, and the proper care before and after operation.

Preliminary ligation, either one or more poles, is regularly done in the acute, severe exophthalmic goitres with chronic and secondary symptoms, cardiac dilatation and loss in weight. The ones that are bad mentally, and those whose sleep is more or less disturbed, are certainly cases for ligation. Marked improvement is shown by this operation, and a safe thyroidectomy can be done in from two to four months, depending on the condition of the patient. These cases, however, will invariably relapse to their former condition if a thyroidectomy is not done. It is well to impress upon the patient and the patient's caretaker the importance of the thyroidectomy after ligation, as the

patient may consider herself well afterward, and you may not hear from her until she has developed a state that is decidedly worse than when the ligation was performed.

Regarding the operative cures, cases are seen which come late for operation with secondary effects in the heart and kidneys. In these cases, of course, one would not expect to get a permanent cure, because the damage was done before the gland was removed. In some cases in which there has been resection of both lobes, in a few months or a year or two the gland will seem to replace itself, and these patients will have a return of symptoms and a second operation is necessary. Many times, clinically, in the non-hyperplastic thyroids, there will occur an almost exact exophthalmic goitre syndrome. The surgeon will think he is dealing with a regular type of exophthalmic goitre, and the difference between these two types of goitre, clinically, is sometimes very hard to tell. A late case is a dangerous case of goitre, and one not improved by ligation of the superior poles. These patients are improved simply by rest in bed and some medical treatment, such as digitalis. This prepares them for a thyroidectomy. They will not bear ether very well and it is better to operate under local anæsthesia. In his own work he gives ether in nearly all exophthalmic goitre cases with one-tenth per cent. novocaine, with ten minims of adrenalin to the ounce. In five years, from 1907 to 1911 inclusive, he had done 119 thyroidectomies for exophthalmic goitre, with two deaths. Eighty-two of these patients have made a permanent recovery. Twenty of these 119 cases received preliminary ligation; one died following operation; two of the cases have recovered simply by ligation.

DR. JOHN B. DEEVER stated that he believed that the majority of exophthalmic goitres originate in a simple goitre. Therefore, the simple goitres are not medical cases, should not see the medical man, but should be referred at once to the surgeon. This has been his teaching for the last few years, also that an exophthalmic goitre seen early should be operated upon immediately. He appreciated the statement that a certain percentage of these cases will get well or be greatly improved, but he believed a much larger percentage will come to operation or will die of toxæmia consequent upon that goitre. Therefore, the question goes back to the original proposition that it is a great deal better to subject the patient to operation in the incipiency of the disease. He had never lost a case of exophthalmic goitre when the conditions were at all favorable for operation. He had, like other men, lost cases in which there was a degenerated heart, whether it was due to myocarditis, advanced nephritis, or what not. A certain percentage will



## THE SURGICAL TREATMENT OF GOITRE

die. If these cases could be seen early they probably would get well. From his experience in following up cases, he said that after early operation many get well and stay well. In the late cases or cases pretty well advanced, although about 50 per cent. do not come to secondary operation, they are not greatly benefited by the original operation.

In the question of boiled water treatment he had had but one experience. The patient was treated at the German Hospital; one of his assistants carried out the treatment and in fifteen minutes the patient was dead.

DR. JOHN D. McLEAN said that in his experience in Philadelphia very few goitres are seen by the medical man. He related, however, a case which he had been watching for seventeen years. The first intimation he had that the patient had exophthalmic goitre was when she developed an extensive and obstinate lupus erythematosus of both eyelids, extending from the temples and back to the ears. The patient had received almost every form of treatment without benefit. The condition was left alone for about two months when it disappeared entirely. Shortly after that the eyeballs began to get a little prominent and the thyroid to enlarge. During the course of this disease the patient developed an abscess of the right kidney which was operated upon with recovery. The greatest improvement in her condition was due to morphine, which was used because she could not sleep. The pulse was so rapid it could not be counted. About two years ago she was sent away from the city to an institution where she was kept at absolute rest of both mind and body for three months, and since then the improvement has been permanent. The gland is almost normal in size, the exophthalmos just the same as at the beginning of the disease. She is in excellent health with the exception that at the slightest exertion her heart becomes very rapid. Concerning treatment he was of the opinion that nothing will do more good than absolute rest of mind and body.

DR. CHARLES H. FRAZIER said that the incidence of goitre on the Atlantic seaboard is insignificant compared with that in the goitre zone farther west. However that may be with regard to simple goitre, there is no doubt that toxic goitre is much more prevalent in the East than it used to be, so that in the eastern clinics we are being confronted with an increasingly large number of such cases. Emphasis should be placed upon the pathology of toxic goitre, because a clear understanding of the pathology is absolutely fundamental to the intelligent management of the disease. In his own clinics he had adopted the classification of Plummer: (1) The non-toxic non-hyperplastic; (2) the toxic

non-hyperplastic, and (3) the toxic hyperplastic or typical exophthalmic goitre.

Attention has been drawn recently to the clinical syndrome of toxic goitre with gastric disturbance. Diarrhoea is frequently observed as a symptom of toxic goitre, but his attention had never been called, until recently, to gastric disorders, and he was rather surprised to learn from the writings of Ewart that he regarded gastric dilatation with gastric disturbance as more or less fundamental to the clinical syndrome of toxic goitre. He said it was the rule rather than the exception.

Another point with which he had been impressed in his rather limited experience was the relationship of tonsillitis to the etiology of toxic goitre. More emphasis should be placed upon this definite relationship in the pathogenesis of the disease. He had been struck by the frequency with which the tonsils have been diseased in his toxic goitre cases. He had seen many cases in which the signs of toxicity followed closely upon attacks of acute tonsillitis, and what is still more convincing, he had seen marked improvement follow the removal of tonsils in such cases. So that now he advocates, where the tonsils are diseased, a tonsillectomy preliminary to ligation or lobectomy. Although his own experience does not include any cases in which either the X-ray or the operation revealed enlargement of the thymus gland, quite a large number of cases are on record now, where there is an associated enlargement of the thymus gland. The exacerbation of the disease in these cases has been attributed to the thymus involvement and the removal of the thymus was followed by very striking relief. Von Haberer gives the records of two or three cases, in which operation upon the thyroid gland itself had failed, and the partial removal of an enlarged thymus gland was followed by striking and immediate relief. It has been recommended that routinely the thymus gland, if found enlarged at the time of operation, be removed. He doubted very much the advisability of this, as it would undoubtedly increase the mortality, and the part which the thymus gland plays in the pathogenesis of the disease is not sufficiently constant.

One of the most important factors is the selection of the time and the character of operation. He was entirely in accord with what the previous speakers had said regarding the avoidance of operating during the acute exacerbation of the disease. He never, at the first visit, gave an opinion as to whether operation was required, of what character it should be, or when it should be performed. This opinion is always reserved, no matter how insistent the attending physician may be that operation be done without delay, or how much better he thinks he

## THE SURGICAL TREATMENT OF GOITRE

understands the patient's peculiarities, until the patient has been under observation at least one, and sometimes two, weeks, usually in the hospital, and always in bed. When in doubt always err on the side of conservatism; boiling water injection is safer than a single ligation, a single than a double ligation, a double ligation than a lobectomy. Upon the theory that in ligation of the superior pole the nerve supply is included, superior pole ligation should be given preference to ligation of the inferior pole. There is no doubt that the functional activity of the gland responds very positively to nerve stimulus, and, if we ligate the entire substance of the superior pole, including the nerves as well as the vessels, we accomplish more than by ligation of the vessels alone. The secondary operation of lobectomy is very much easier to perform if the superior poles are exposed through independent incisions one-half inch below the upper margin of the thyroid cartilage.

It is a curious fact that there is no consensus of opinion upon the selection of an anæsthetic. Looking the world over we see in three large clinics Kocher using local anæsthesia, Ochsner using ether, and Crile, nitrous oxide. As each anæsthetic is advocated in equally strong terms the choice must be left to one's own judgment and experience. A strong argument can be made for general narcosis as against local anæsthesia, in all forms of toxic goitre, and an equally strong argument for nitrous oxide as against ether. He believed absolutely in the application of the general principles of anoci-association.

Except in one or two cases he had not employed boiling water injections, so that he could not speak of this procedure from personal experience. In very severe cases the mortality may be as high perhaps as in ligation. Statistics from the Mayo Clinic give two deaths from ligation and two from the boiling water injection. This is not offered as a criticism against the latter treatment, but merely to show that no matter which method is used in the very severe cases, there are bound to be fatalities.

The expectation of life in the natural history of goitre is an important question as applied to the indication for surgical therapy. In the untreated cases the tendency in the gland to undergo a process of retrograde metamorphosis, and for the condition to be transformed from one of hyperthyroidism into one of hypothyroidism, is not to be lost sight of. The possible sequence of events is one of the strongest arguments in favor of early operation, since in the terminal stages the prognosis is invariably grave and surgical intervention futile.

DR. OCHSNER, in closing, remarked that as to tonsillar infection in goitre of adolescence, he believed that at least 75 per cent. of the

## PHILADELPHIA ACADEMY OF SURGERY

cases that he had seen became permanently well by removal of the infected tonsils, by drinking boiled water and following a sensible diet and hygiene, and by getting 8 to 10 hours of sleep with open windows. In certain places in Michigan and Illinois there were goitre wells. Farmers whose children were free from goitre when living in a certain section found that they began to develop goitres upon moving to another farm. In these cases no further goitres develop if all drinking water is boiled. He referred to experience quoted by Dr. Bircher. Seventy per cent. of the entire population of Rapperswyl in Switzerland had goitres so long as they used the water from alluvial soil on one side of the valley, but when the water was used from the granite rocks from the other side of the valley, the goitres disappeared from the children in the village. The same conditions were noted in two young ladies' seminaries situated a mile and a half apart.

Hyperthyroidism seems to affect certain muscle groups. A patient coming into one's office may suddenly, when she sits down, drop her weight into the chair. Perhaps a woman brings her daughter, and says she constantly drops the dishes or anything she attempts to carry; that when she goes upstairs her heart beats rapidly, and her legs refuse to carry her. He had seen cases sent to the hospital for operation for dilatation of the stomach in which the stomach muscles were affected and the stomach relaxed because of hyperthyroidism and in which tremor and tachycardia were present, in which no attention had been paid to the thyroid gland.

He had not been able to make out the enlarged thymus gland as an accompaniment of hyperthyroidism. He had not been able to outline a thymus gland in his thyroid cases, although the X-ray plates have shown frequently that the hyperthyroidism is accompanied with enlargement of the thymus gland.

X-ray treatment seems to increase the general hyperæmia and he had had a lot of cases upon which he had operated who had previously received X-ray treatment for a while. Several years ago C. H. Mayo wrote a paper on "X-ray in Hyperthyroidism," and he used the treatment in a series of cases at that time. He thought at first that it might improve the condition of these patients, but he could see no permanent benefit. It is so very easy to imagine that this or that form of treatment helps a case of hyperthyroidism. In this connection he had a very peculiar experience. A friend of his whom he had known for many years and who had practised in Colorado, found that goats that were infected with a certain parasite had goitres, and that if they were dipped the goitres disappeared. Also if some form of mercury was



## THE SURGICAL TREATMENT OF GOITRE

administered the goitres disappeared. He thought that the same remedy would cure exophthalmic goitres in man and tried it upon all the cases he could get. There were at that time two patients in the hospital nearly dead with hyperthyroidism. In one of these Dr. Ochsner tried the remedy, while the other one was so seriously ill that he did not dare to risk the use of any remedy, and in three weeks both were so much improved that he was justified in removing the gland and they both got well. He had a patient who came from Michigan with bad hyperthyroidism whom he intended to treat in the same way, but as he was going out of the city for a time and had not the remedy at hand, he simply gave her a diet list and general directions for rest and hygiene, and in three weeks when he returned, the goitre was almost well. She had come from a goitre-well region. He had had any number of similar experiences. In one case a woman came from Mexico, Mo., who had consulted a physician in St. Louis, who advised her to use a certain kind of pad said to cure goitres. When she returned to learn how to apply the pad a few weeks later, the condition had improved remarkably and this improvement was at once credited to the action of the pad by the medical man, when in reality the pad had not been worn at all. Under almost any quieting treatment these cases will improve to a certain point where it is safe to operate. He had been so convinced of this that during 1915 he operated upon 106 cases and used this plan throughout, with but one death. The fatal case was a big strapping fellow from the South, who seemed in such good general condition that he felt he could operate at once, notwithstanding rather marked hyperthyroidism. The year before he had operated upon a daughter of this man who was in a fearful condition, keeping her quiet for ten days prior to operation. This man was one of the stubborn sort who would not keep still; he would jump up and exert himself unreasonably, and in one of his jumps he had an acute dilatation of the heart and died. Had he kept him still for a few days before the operation, he would probably have lived through the operation. Of 561 cases operated during six years previously, he had lost 16 cases, so that the death-rate was three times as high before he carried out this plan absolutely.

No doubt local anæsthesia is the best if one can treat his patients as Kocher does. When he talks to them they hold still, no matter what happens. If one can do that, it works. Recently he had one of these patients. When the patient was brought up the anæsthetist said, "I don't think we had better risk that case." The pulse was 160 and went to 170 and 180. Dr. Ochsner went out and spoke to her about local



#### PHILADELPHIA ACADEMY OF SURGERY

anæsthesia and she said, "Anything you say is all right." He knew that in that frame of mind taking out the thyroid would not do her any harm. He used novocaine and she sat up the same afternoon and was out of bed the next day.

Regarding gastric lavage after thyroidectomy, it should not be forgotten that if the stomach is washed out with water at 100° F., the patient will be very much less likely to suffer from post-operative hyperthyroidism.

DR. PORTER, in closing, said that in the vast majority of the so-called simple goitre cases later hyperthyroidism develops and in the end myxœdema. All of the myxœdema cases at one time or other were cases of hyperthyroidism, so-called. If they live through they will become myxœdemic. That is the reason they become fat.

He would emphasize the point made by Dr. Deaver that the majority of cases of exophthalmic goitre were once simple goitres. It corresponds with what we know of the history of goitre checked up with the microscope. It is true that an occasional case of so-called exophthalmic goitre is met with without a palpable goitre. While this is possible, it is very rare.

He had never seen a malignant thyroid which was not engrafted upon a simple thyroid. If that be true, and it be true that exophthalmic and toxic goitres were once simple goitres, surgeons are abundantly warranted in saying that every simple goitre should come out.

Regarding the end results in thyroidectomy, he was not unmindful of the fact that the thyroid is a protective agent perhaps against all sorts of infection and intoxication; but, if by thyroidectomy one happens to make a little too extensive removal of the thyroid, one has not done anything more than Nature will do if the individual lives long enough. Ultimately the thyroid will undergo cytolysis; all the cells will be broken down and the individual will be in the position of the myxœdemic patient.

One word about the injection of boiling water. *Per se* the treatment is without risk. A certain per cent. of these patients will die in spite of any treatment. The mortality that follows the boiling water injections is the result of the disease rather than the treatment. That the boiling water treatment is a life-saving procedure in properly selected cases has been proven. It has been said that the way to cure hyperthyroidism is to take out the thyroid. This should be the treatment of choice when it can be done without risk.

# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY

*Stated Meeting, held April 12, 1916*

The President, DR. CHARLES N. DOWD, in the Chair

### FOREIGN BODY IN THE OESOPHAGUS

DR. GREEN presented a man twenty-two years old who, on February 5, 1916, while asleep, swallowed a hard rubber dental plate with three teeth. He was admitted to the Surgical Service of St. Luke's Hospital the same day and was X-rayed by Dr. Le Wald. A very clear röntgenogram showed the outline of the plate with the three teeth downward lodged in the upper part of the oesophagus. Without delay, under cocaine and adrenalin anæsthesia and with the aid of a short oesophagoscope, the foreign body was located. It was grasped with forceps through the oesophagoscope and removed together with the instrument. He was advised to remain in the hospital the following day in case of reaction from any possible laceration, and was discharged at the end of that time with no further discomfort.

### ABSCESS OF LUNG

DR. BENJAMIN T. TILTON presented a man, thirty-seven years old, who five years ago had an attack of acute lobar pneumonia on the left side, and was sick in bed two weeks. After this he had winter cough every year, and was never in as good health as before the pneumonia. Last summer he complained of pain in the right side of his chest, had a cough and expectoration and was losing weight. His sputum was repeatedly examined at this time and reported negative for tubercle bacilli. He gradually became weaker, expectoration increased and, when admitted to the hospital on October 31st last, gave the appearance of a patient with pulmonary tuberculosis. He was much emaciated, with flatness over the entire lower part of right chest and absence of breathing sounds. A needle inserted two inches found pus. The sputum was abundant, purulent and foul-smelling. The X-ray picture was not satisfactory.

A diagnosis was made of abscess of the lung involving the lower lobe. On account of the long duration and the history of previous pleuritic pain, it seemed probable that the visceral and parietal pleuræ were adherent and there would be no danger of pneumothorax from

## NEW YORK SURGICAL SOCIETY

opening the chest. His temperature was 99 to 100, pulse 126, and respiration 26.

On November 1st, the ninth rib was resected under novocaine owing to the fear of employing a general anæsthetic. A large amount of pus was evacuated and the finger explored a large cavity in the lower lobe. Two drainage tubes were inserted. The patient was kept in the open air during the next weeks. The expectoration of pus stopped almost immediately and the general condition improved very gradually. He was discharged on December 15th, six weeks after the operation, with a sinus still open.

No organism could be isolated from the pus taken from the chest. Three days after admission the sputum was positive for tubercle bacilli, and also a month later.

At the present time, five and a half months after the operation, the patient has gained 40 pounds, has no cough or expectoration and the sinus has been closed three weeks.

The X-ray plate taken a few days ago shows a marked infiltration at the base of the right lung due to healing of the abscess.

The case seems worthy of report in view of the successful result in spite of the long duration of the abscess. As is well known, chronic abscesses do not give favorable results from operative treatment on account of the indurated condition of the adjacent lung tissue preventing a collapse of the abscess wall. The prompt healing of the fistula and the lung and the marked gain of weight and disappearance of all pulmonary symptoms would seem to point against a tubercle etiology.

### HEMORRHAGE AFTER GASTRO-ENTEROSTOMY: RECOVERY AFTER TRANSFUSION.

DR. TILTON presented a man forty-two years old, who had had stomach trouble for five years. This began with fulness after meals, belching of gas, pyrosis and nausea which came about an hour after meals. These symptoms occurred intermittently for three years. Two years ago he began to have severe pain in the epigastrium about an hour after meals and also a gnawing pain at night. The pain was relieved by taking food. For the past few months has been vomiting considerably and sometimes food that he had eaten the day before. He had lost twenty pounds in weight.

The X-ray findings were reported by Dr. Hirsch to be those of chronic duodenal ulcer with thickening and obstruction at the pylorus, enlargement of the stomach, atony and hypersecretion.

*The Stomach Analysis.*—One hour after a test meal of a roll and

## HEMORRHAGE AFTER GASTRO-ENTEROSTOMY

250 c.c. of water, 375 c.c. was obtained of a strongly acid odor. Free HCl 54; total acidity 88; no lactic acid; no blood; microscopically undigested food particles, mucus and shreds.

Operation performed March 18th, revealed a markedly dilated stomach, a mass at the pylorus about the size of a mandarin, non-adherent and without glandular enlargements. A posterior no-loop gastro-enterostomy was done as quickly as possible. The patient was in no condition for pylorotomy, which is the operation of choice in these cases even though the pyloric mass is benign in appearance. The patient did not vomit once after the operation and his condition was in every way satisfactory until the fourth day, when blood appeared in the stools and the pulse went from 80 to 120. During the next two days the blood continued in the stools, but there was no vomiting. The hæmoglobin gradually went down to 20 and the pulse reached 140. A marked apathetic state of mind gradually supervened and it was evident that something radical would have to be done.

Injections of horse serum had had no effect upon the bleeding. A transfusion seemed indicated and was performed by Dr. Unger by his own method on March 24th, six days after the gastro-enterostomy. Five hundred c.c. of blood were transfused and the immediate effect was marvellous. The depressed mental state cleared up immediately, the hæmoglobin rose to 30, the pulse dropped to 110 and a few days later to normal. The hæmoglobin in fourteen days was 80 per cent. There was no recurrence of blood in the stools.

The patient is leaving the hospital to-day and for the past week has been on regular diet. This seems to be a benign stricture of the pylorus but it is uncertain whether there may not be germs of malignancy in the chronic ulcers which will be heard from later. The transfusion certainly saved his life from slow hemorrhage.

DR. W. A. DOWNES asked Dr. Tilton what he considered the source of hemorrhage and the type of suture he used in the case reported. He asked this question because last year he had a very severe hemorrhage following gastro-enterostomy, coming on in twelve hours, with such severity that immediate re-operation was required. This patient lost considerably more than a quart of blood and was in collapse. The gastro-enterostomy was made with a continuous self-inverting stitch, but the larger vessels were not ligated separately as should be done. Upon re-opening the case through a gastrostomy, free bleeding was apparent along the margin of the stoma. This was controlled by continuous catgut suture and the patient recovered.

Dr. Downes does not think it is correct to assume that all cases of hemorrhage following gastro-enterostomy will stop spontaneously,



## NEW YORK SURGICAL SOCIETY

but that treatment must be decided according to the symptoms in each case.

DR. F. TOREK said that the important thing to prevent hemorrhage is to tie all the vessels, not to depend on the suture. Apparently this particular precaution is not attended to by a great many in doing gastro-enterostomy. The excuse perhaps lies in the fact that while the stomach and the intestine are clamped no bleeding is seen. Since he had adopted the plan of tying every visible vessel in the incision of the stomach, he had never had a hemorrhage.

DR. TILTON added that at the last meeting Dr. Woolsey reported a case of gastro-enterostomy with hemorrhage on the ninth day, which persisted in spite of horse serum and transfusion. He did gastrotomy, and found that there were no signs of an active bleeding at all. To make sure, he passed a suture around the anastomotic opening. The second operation in this case was perhaps unnecessary and could have been avoided by a second transfusion.

A transfusion should always be tried before opening the abdomen a second time. Its value in stopping the hemorrhage from gastric and duodenal ulcers is unquestionable. He had had two other cases of serious hemorrhage after gastro-enterostomy. The hemorrhage came on in both cases within the first twenty-four hours, and the patients were both exsanguinated, but recovered without secondary operation.

From observing these three cases he had concluded that a secondary laparotomy is very seldom necessary in these cases. Certainly the two cases just spoken of were very alarming cases of hemorrhage. But these cases will usually take care of themselves. The hemorrhage will stop just as soon as the arterial pressure goes down. Secondary opening of the abdomen under these conditions is an operation of considerable magnitude and may in itself turn the scale against the patient.

### EXCISION OF REDUNDANT CÆCUM AND ASCENDING COLON FOR EXTREME CONSTIPATION

DR. W. A. DOWNES presented a man thirty-four years of age, who had suffered from extreme constipation for many years. About one year before admission to the hospital, patient had pain in right upper quadrant of abdomen, radiating to back and shoulder, occurring most frequently during night. No nausea, vomiting or jaundice. During attacks he would have frequency and urgency of micturition. Micturition gave him some relief. Bowels averaged one movement a week. Stomach was lavaged and he was advised to take cathartics which had no effect on him. Seven weeks before admission, he went to Bellevue Hospital where he was treated six weeks.



## EXCISION OF CÆCUM AND ASCENDING COLON

Examination of abdomen showed no rigidity. There was some tenderness on deep pressure over right side, especially over right lower quadrant, where there was palpable a rounded movable mass occupying position of cæcum. Liver and spleen not felt. X-ray examination showed (five minutes after bismuth injection) that the bismuth had travelled back as far as cæcum. The cæcum, ascending colon, and hepatic flexure were distinctly dilated. The sigmoid flexure was markedly elongated.

Operation consisted of excision of the ileocæcal coil with ascending colon and anastomosis of the ileum to the transverse colon. The patient made an uneventful recovery and now six weeks after operation states that his bowels move freely every day without catharsis.

### LARGE HYPERNEPHROMA: WELL FIVE YEARS AFTER OPERATION

DR. DOWNES showed a man forty-five years of age, from whom he had removed a large hypernephroma, five years previously. The fact that so few cases of tumor of the kidney of this nature remain well for any length of time made it seem worth showing his case again. The man is now in perfect health, having gained considerable weight. The tumor which was 8 inches in diameter was removed through a large transverse incision.

It is interesting to know that Dr. Abbe states that a patient from whom he removed a large adenocarcinoma of the kidney some twenty-four years ago remains well at this time.

### EXCISION OF THE CÆCUM AND ASCENDING COLON FOR CARCINOMA

In presenting this case Dr. Downes wished to emphasize the point that a sufficiently large incision should be made in all abdominal cases in which the symptoms were of chronic nature. The patient showed was first admitted to St. Luke's Hospital on October 20, 1915, with a diagnosis of chronic appendicitis, and, as is the custom, one X-ray picture was taken to exclude a stone in the ureter. This picture being negative, the appendix was removed through a McBurney incision.

The patient was readmitted on February 28, 1916, complaining of the same pain which he had had previous to the operation. At this time a bismuth series was taken of the gastro-intestinal tract, and it was very evident that there was a stricture near the hepatic flexure of the colon. He was re-operated and an adenocarcinoma of the ascending colon was found.

This case further illustrates the value of the routine X-ray examination of the intestinal tract in all cases of chronic conditions.

## NEW YORK SURGICAL SOCIETY

### ADENOCARCINOMA OF THE SIGMOID

DR. PARKER SYMS presented a man thirty-three years of age, who was admitted to Lebanon Hospital, December 23, 1915, suffering from acute complete intestinal obstruction. Bowels had not moved in five days; the patient had severe abdominal pain and vomiting. No gas was passed; the abdomen was distended and tympanitic. Dr. Bookman performed a colostomy the day of admission; the result was immediate relief. Before the bowel was opened Bookman explored the abdomen and found a tumor in the lower part of the sigmoid. There was an enormously distended bowel above this tumor, and a good deal of congestion and thickening in the neighborhood of the tumor. Bookman wisely made a colostomy in the upper part of the sigmoid so that the colostomy opening and the tumor might be removed *en masse* at a subsequent operation. This patient had been admitted to the Lebanon Hospital on the 29th of August with a history of intestinal obstruction. At this time he was relieved by enemata. He gave a history of a similar attack six months before that date.

January 13th, Dr. Syms resected the sigmoid and colon, removing the tumor and the colostomy *en masse*. An end-to-end anastomosis was effected by the method described by William Mayo in 1909, which was as follows: After the bowel had been mobilized the desired amount was resected between clamps, and about fourteen inches of the bowel were removed. This included the sigmoid and the lower part of the descending colon. A long tube passed through the lower part of the bowel and out through the anus. The upper end of this tube was left protruding about three or four inches, and was introduced into the upper segment of the bowel. A few interrupted sutures secured the two ends of the bowel together and the bowel was stitched to the tube. By traction on the tube, and by manipulation, the upper end of the bowel was invaginated or telescoped into the lower segment. After this invagination was accomplished a few interrupted sutures were introduced which held the bowel together and the junction was complete. The abdomen was closed, two rubber tissue drains being inserted as a precaution. The patient made an uneventful recovery. There was no leakage at any time. There was slight bowel movement through the tube while it was in place, and complete and satisfactory movements from the time the tube was removed which was on the fifth day.

### TONGS FOR TRACTION IN THE TREATMENT OF FRACTURE

DR. PARKER SYMS showed a new instrument which he has recently devised and which he believes to be superior to the Steinmann pin apparatus. In 1912 at the meeting of the American Surgical Association,

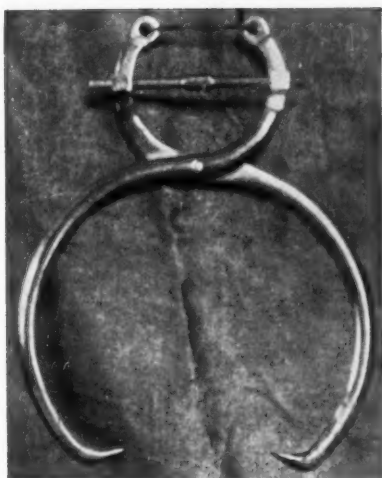
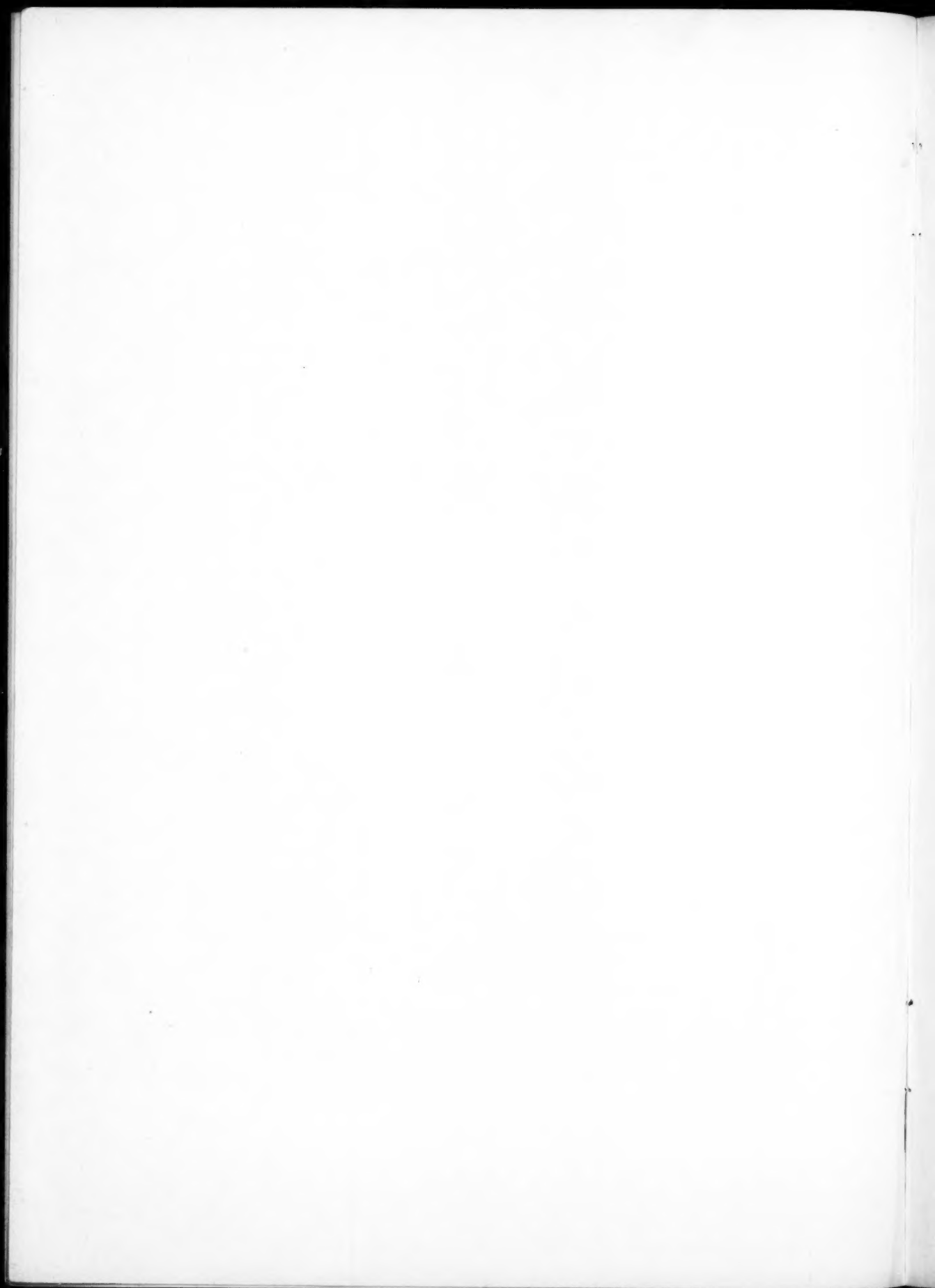


FIG. 1.—Modified ice-tongs ready for use.



FIG. 2.—Showing plaster case applied with tongs still in position.



## EXCISION OF CANCER OF COLON

Dr. J. Ransohoff advocated the use of ordinary ice tongs in the treatment of fracture of the femur. He pointed out the fact that traction applied directly to the lower end of the bone by means of tongs accomplished the desired result in a very definite manner. He showed that by this means one may avoid the damage to the knee joint which so frequently follows the employment of Buck's extension by the old method. He was much impressed with the Ransohoff proposition. Of course, the Steinmann apparatus accomplishes the same object in very much the same way, but it has the objection of the complete penetration of the bone by the pin. The tongs are superior to the Steinmann apparatus because the bone is only penetrated superficially. At Lebanon Hospital the Steinmann apparatus has been used many times during the last two or three years and so far there has been no cause to regret its employment, but serious results have followed its employment in other hands, and its use is not entirely free from danger.

The instrument now shown is modelled from the ordinary ice tongs. Of course, it is very much lighter and more refined. A turn buckle has been added, by means of which the tongs cannot only be held firmly in position after they have been implanted, but from time to time they can be tightened by turning the screw.

Dr. Syms had employed this instrument but once. In that case it was of particular use. It was a case of T-shaped fracture of the lower end of the femur, and it can be readily seen that by screwing the tongs tight together the two condyles were held in apposition and traction was made on the lower end of the femur as if it had not been broken longitudinally. Another great advantage as shown in the accompanying illustration (Figs. 1 and 2) is the fact that a plaster case can be applied while the tongs are in position and while traction is being made. After the plaster has set the tongs may be removed. In the case referred to, he simply stuffed a little sterile gauze into the openings without making any further dressing.

## EXCISION OF CANCER OF COLON

DR. PARKER SYMS presented a specimen of adenocarcinoma of the colon removed by operation, October 26, 1911, from a woman, seventy years of age, who had stenosis at the splenic flexure caused by an annular carcinoma which produced almost complete obstruction. The operation was done as an emergency one. At the time of her operation, patient was on the verge of a broncho-pneumonia which developed after the operation.

The abdomen was opened through the left rectus muscle; the obstruction was found at the splenic flexure. It appeared as a constriction rather than a large mass. The surgical diagnosis was an



## NEW YORK SURGICAL SOCIETY

obturating carcinoma. On account of the patient's precarious condition the tumor was not removed, but a short circuit was made by anastomosing the transverse colon with the descending colon some inches below the tumor. The patient had a stormy convalescence. Besides her pneumonia she had acute dilatation of the stomach requiring frequent siphonage and lavage. She finally recovered.

A remarkable thing about the case is that the patient made an apparent complete recovery; her anastomosis functionated satisfactorily as was shown by clinical evidence as well as by X-ray pictures. She was able to travel to Europe and about this country, and lived in apparently perfect health for four years.

In December, 1915, she had evidence of abdominal disturbance. There was some difficulty in moving her bowels. However, this was accomplished satisfactorily with enemata and later cathartic. On December 17, she seemed very well in the morning but in the evening she had an attack of violent pain in the abdomen, and died that night from perforation of the bowel above the anastomosis.

This case is reported with the object of showing the advantage of physiological rest in such cases. After a lapse of four years the disease had made no appreciable progress. The diagnosis of the adenocarcinoma was confirmed by microscopical examination in the laboratory of Cornell University.

DR. WIENER said that resecting carcinoma of the sigmoid seems to give a much better prognosis than the removal of carcinoma through other parts of the large intestine. About eight years ago he operated for carcinoma of the sigmoid flexure. The tumor was adherent to the anterior abdominal wall and the omentum, and was about the size of a grape-fruit. He had to resect some of the abdominal wall to get the tumor out. He finally got it out after an hour and a half of pretty steady work; and when he started to bring the ends of the intestine together the nurse exclaimed that the patient was pulseless. So he dropped it with just one suture around it, and stopped, thinking the patient was moribund. The patient did not die, he got better; and after six weeks Dr. Wiener closed the fecal fistula, and the patient went along and remained well. When last heard of, six and a half years after the operation, he was still well, in spite of the fact that he had had what was apparently an inoperable tumor of the sigmoid involving the abdominal wall.

## FUNCTIONAL RENAL TESTS

DR. EDWIN BEER read a paper with the above title for which see page 434.

## OSTEOPLASTIC RESECTION OF THE SKULL

*Stated Meeting, held April 27, 1916*

The President, DR. CHARLES N. DOWD, in the Chair

### OSTEOPLASTIC RESECTION OF THE SKULL

DR. LUCIUS W. HOTCHKISS presented a man, twenty-one years of age, who was admitted to the medical side of Bellevue Hospital, January 30, 1916, with a history of only two or three weeks' duration. He noticed, without any previous injury or any history of venereal or other disease, that he began to have dull frontal headache which has been continuous and is accompanied with increasing dimness of vision. Once or twice he has had vomiting of a projectile type. On admission he was dull and stupid looking; no scars, pigmentation or eruption, his general physical examination negative. The blood-pressure was from 160 to 180 mm. Hg. As his symptoms continued to grow worse, tumor was suspected and the case was seen by a neurologist who found chronic papillædema, some disorder of the olfactory sense, a distinct weakness of the right facial region,—central type, and slight weakness of the right arm. He became incontinent, was mentally dull but not aphasic, all of which in the opinion of Dr. Kennedy pointed to a lesion of the left side of the brain, probably frontal. Wassermann—negative. Lumbar puncture,—60 c.c. clear fluid under pressure. Cell count—60. Noguchi—positive.

In view of the signs of increasing intracranial tension as shown by the diminution in vision and the condition of the fundus, a subtemporal decompression on the right side was recommended, to be followed later by a broad exploratory operation upon the left side to locate and remove, if possible, the cause of the trouble.

The right subtemporal decompression was done by Dr. Vosburgh with great relief of the symptoms—the headache disappearing and the vision improving. At this operation great intracranial tension was found and relieved—wound healed.

Two weeks later the exploratory operation was proceeded with, as follows: A broad horse-shoe-shaped flap was marked out so as to afford a good exposure of the left frontal region of the brain. The base of the flap was well down upon the squamous plate of the temporal bone where the bony flap was broken through.

The first incision was made parallel to, and a finger's breadth above, the supraorbital ridge from the zygoma to a point three-fourths of an inch from the median line of the skull; the second incision extended

backward from this parallel to the median fissure and about three-fourths of an inch to the left to a point opposite the upper end of the Rolandic fissure. From this a third cut was made, passing across the left parietal and temporal region to a point above the ear, thus marking out a large osteoplastic flap, with a narrow base in the temporal bone, near the base of the skull. The Hudson drill was used to make openings at several points after the periosteum had been pushed back, and these openings were connected by sawing through the skull with a Gigli saw. The large flap was fashioned without much hemorrhage and was fractured at the desired point. When the flap of bone was laid back, it was found that a very wide exposure of the left frontal region of the cortex had been obtained. As there was no evidence of intracranial tension shown by bulging of the dura, and as the patient at the end of an hour showed some shock, the flap was replaced and the search for the possible tumor postponed until a later date.

#### LEFT INGUINAL HERNIA

DR. JOHN B. WALKER presented a man twenty-seven years of age. First noticed a swelling in upper part of left scrotum one year ago; no injury and has not worn a truss. When standing there appears in upper portion of the left scrotum a soft elastic mass which is reduced through the external inguinal ring into the abdomen. The left side of the scrotum is small, undeveloped, and the left testis lies in the inguinal canal just internal to the external ring and between the aponeurosis of the external oblique muscle and the internal oblique and the transversalis and it cannot be brought below the external ring.

Gas and ether anæsthesia. A four-inch incision over the middle of the left inguinal canal, through the skin, fascia and aponeurosis of the external oblique muscle. The sac and cord structures are lifted up. A catgut ligature is passed underneath them and used as a retractor. The sac is opened and found to be congenital. It is separated from the vas and vessels, its neck freed high up, transfixed and ligated with No. 1 catgut. The lower portion is used to form a new tunica for the testis. By very careful dissection the testis is freed from the shortened fascia which has retained and prevented its descent. The vas and vessels are found sufficiently long enough to permit the testis to be brought down into the scrotum. The internal oblique and transversalis muscles are united to the lowermost shelving edge of Poupart's ligament by four interrupted No. 2 chromic gut sutures. The aponeurosis of the external oblique is closed by a continuous No. 2 chromic suture. The skin is closed by a zero plain catgut subcuticular suture.

## CARCINOMA OF COLON

The duration of the operation has been 40 minutes. The patient will remain in bed for twelve days, will wear a bandage for three weeks, after that no further support will be required.

### FRACTURE OF NECK OF FEMUR

DR. JOHN B. WALKER presented a man, fifty-four years of age, moderately stout, who two days ago fell, striking on his left hip. He was unable to rise or to stand when lifted up. He was brought to hospital in ambulance with a Hamilton side splint. Outward rotation was present, also three-quarter-inch shortening. A radiogram was taken which showed an irregular oblique fracture through the neck of the left femur.

The patient was placed on the Hawley extension table and anaesthetized with ether. The patient was drawn down to the perineal post, the perineum being protected by a thick pad; the right foot was attached to the right foot-piece of the extension bar and the right leg was then gently abducted to its normal limit in order to serve as a guide for the injured leg. The left foot was attached to the left foot-piece of the extension bar. Extension was applied until the shortening was overcome and then the leg was abducted to correspond with the normal leg. After carefully bandaging the leg with cotton wadding, a plaster case was accurately applied from the lower border of the ribs to and including the left foot. The left knee was slightly flexed. After the plaster had become solid it was cut through anteriorly from the knee to the toes so as to avoid any undue pressure. The anaesthesia required about thirty minutes. The patient will remain in bed with the case for about five or six weeks. The case will then be removed up to the knee and the patient allowed up on crutches, but the patient must not bear any weight upon the left leg until the end of twelve weeks.

### CARCINOMA OF COLON DISTAL TO SPLENIC FLEXURE

DR. JOHN A. HARTWELL presented a woman forty-two years of age who had been admitted to the hospital two weeks previously, suffering from an acute intestinal obstruction that had been present for five days. At the time no history could be obtained which gave any clue to the cause of the obstruction; accordingly, a suprapubic laparotomy was performed, through which enormously distended coils of small intestine presented. No exploration was possible until these coils were emptied by several punctures with the trocar and cannula, supplemented by suction. The tumor in the left upper abdomen was then palpated and it was determined that the patient's condition would not justify an attempt at its removal. A lateral caecostomy was performed with a Paul's tube.

The post-operative condition was satisfactory. Fecal discharge was thoroughly established at the end of twenty-four hours, and the patient's condition became such as to justify an attempt to remove the growth. Owing to the cæcostomy wound, and a superficial infection in the suprapubic wound, it was deemed advisable to completely isolate these from the operative field. This was done by covering them with rubber dam made adherent with chloroform, over which adhesive plaster was tightly applied. Before operating this was painted with 7 per cent. iodine, and the usual preparation of the upper part of the abdomen with 3½ per cent. iodine was done. This necessitated the transverse laparotomy incision, which was carried out midway between the umbilicus and ensiform, from the midline to the midaxillary line. The exposure thus obtained was satisfactory, and the final closure of the abdominal wall was without difficulty. The carcinoma was found to be an annular tumor of about two inches in extent, and after removal was demonstrated to leave only a lumen of the diameter of a lead pencil. It was firmly adherent to the peritoneum posteriorly, directly over the kidney. The tumor was approached by dividing the colon 3 inches below it between Payr's clamps, and the two ends were then closed by ligating directly around the bowel just proximal to the clamp, and inverting the crushed and cauterized end inside a purse-string suture of Pagenstecher reinforced with some interrupted Pagenstecher stitches. A lateral anastomosis was then done by means of the Roosevelt clamp, between the transverse colon and the descending colon, the same technic being used as in the ordinary gastroenterostomy.

Dr. Hartwell explained that in doing this no continuous linen suture was used, and that for the hæmostatic suture he preferred the simple through-and-through buttonhole rather than the suture with the loop on the mucosa. Drainage tubes were led out through the lateral extremity of the abdominal incision in such a way that they would provide an outlet in case of leakage from either closed end or the anastomosis.

Dr. Hartwell expressed the opinion that the four or five inches between the anastomosis and the closed end of the splenic flexure would not be the cause of trouble because the reverse peristalsis would very easily prevent undue distention of this portion. In fact it was hoped that this pouch would in some sense act as a reservoir to prevent the too prompt discharge through the anastomosis.

**NOTE.**—Dr. Hartwell reported the post-operative progress of the patient as satisfactory, and the danger of a fistula seemed to be past at the time of the report. The bowels were moving normally and the fecal discharge through the cæcostomy was almost nothing.



## CHRONIC PERFORATION OF DUODENAL ULCER

### CHRONIC PERFORATION OF DUODENAL ULCER

DR. GEORGE WOOLSEY presented a man thirty-one years of age who was admitted to the hospital April 21, 1916, complaining of pain and tenderness in the right upper abdomen. In May, 1914, he had had his appendix removed; since then no digestive trouble until April 10, 1916, when a burning pain began in the epigastrium, relieved for about an hour by eating. On April 10th, he had a sudden sharp pain in the right subcostal region, persisting until admission as a constant sharp pain, relieved somewhat by lying on right side, and radiating frequently to the right shoulder. When lying on the back there is sometimes pain in the left tenth interspace posteriorly. No vomiting and no blood in stools or sputum. No previous similar attack.

Examination showed considerable tenderness and resistance over the right rectus below the costal margin. The temperature, 101.5 on admission, came gradually down to normal in three days. Test meal showed the following: 60 c.c. recovered; free HCl; total acidity 57; no occult blood. X-ray examination showed a very high arched right dome of the diaphragm, and corresponding to this at the right base, posteriorly and in the axillary line there are dullness on percussion and decreased breath sounds, and vocal and tactile fremitus, from the eighth space down. The tenderness and resistance gradually diminished. The signs pointed to a cholecystitis, the X-ray to a subphrenic abscess or abscess or cyst of the liver. Aspiration of chest was negative.

On operation, April 27th, the pathological findings were as follows: There were recent adhesions all through the right upper quadrant of the abdomen, some of them between the liver and diaphragm, but the dome of the right lobe of the liver was free. On freeing very firm old adhesions between the edge and under surface of the liver, the duodenum, pylorus, omentum and gall-bladder, an old abscess cavity lying between the duodenum and pylorus and the liver and containing about one ounce of pus was opened. Corresponding to this is a sharply outlined, indurated area on the anterior wall of the duodenum, due to an ulcer which at present is closed. Gall-bladder contained no stones but is thickened and contracted, probably due to extrinsic inflammation.

*Procedure.*—The abdomen was opened by a 4½-inch transverse incision on the right side 1½ inches above the umbilicus. The adhesions were separated, the abscess contents sponged out, a posterior short-loop gastrojejunostomy made with two rows of No. 0 chromic catgut, and the gall-bladder shelled out from its thickened coverings. Cystic duct clamped and sutured. A cigarette drain was introduced to abscess cavity and across stump of cystic duct. Wound sutured in layers.

## CHOLECYSTITIS

DR. GEORGE D. STEWART presented a woman, age fifty-one, who has a family history of tuberculosis. Previous history—was treated for tuberculosis at Otisville during the past nine months. Never had typhoid. Menstruation regular. Operated on four years ago for mastoiditis. Three years ago she was seized by sudden pain in right hypochondrium, constant, dull, aching in character, without radiation, relieved on the third day by a severe attack of vomiting, jaundice appeared after the initial attack and persisted for several weeks. Similar attacks have occurred every one or two months since; in all there was pain followed by vomiting and jaundice. The last attack occurred five months ago and was characterized by weakness and loss of weight. Her physical examination showed evidences of tuberculosis over both clavicles; slight tenderness over the gall-bladder, marked tenderness over the appendix. Clinical examinations were not significant. Radiographic examination states that there was nothing abnormal in either urinary tract, but that calculi were present in the gall-bladder.

The operation history is as follows: Moschcowitz transverse incision. Appendix removed (normal diameter at tip but merely a fibrous cord between tip and base). Gall-bladder distended. No calculi. Cholecystotomy. Drain.

Pathological report shows appendix atrophic. Cultures of bile showed colon bacillus.

*Remarks.*—The interesting thing about this case was the utilization of the transverse incision recommended by Moschcowitz for operation in the upper abdomen. It was the first time Dr. S. Stewart has used this incision, and he made it under the direction of Dr. Moschcowitz, who was present. It was easily made, gave a remarkably good exposure and was easily closed.

The fact that the nerve supply was spared and the majority of fibres, both muscular and fascial, with the exception of the rectus, were separated rather than divided, would warrant, it seems, a favorable prognosis as to the occurrence of hernia in the future.

The case was also a tribute to the uncertain value of the X-ray in detecting biliary calculi.

## GASTRIC ULCER—PYLORECTOMY

DR. JOHN DOUGLAS presented a man, age forty-seven, who has had attacks of sharp epigastric pain followed by vomiting for the past seven years. Vomiting relieves pain,—but patient occasionally vomits with-

## EMPHYEMA OF THE THORAX

out pain. Pain bears no relation to the ingestion of food. No hæmatemesis or melæna. Feels well between attacks.

*Physical Examination.*—Negative except for slight tenderness in the epigastrium. String test positive 47 cm. from teeth.

*Laboratory Examination.*—Wassermann negative. Stools negative for occult blood. Gastric contents practically normal. X-ray examination shows perforating ulcer of lesser curvature.

*Operation.*—Vertical incision through right rectus muscle. Indurated ulcer with crater 1 cm. in diameter on lesser curvature about 3 cm. from pylorus found. A V-shaped excision, or a Balfour cauterization operation would have caused so much deformity near the pylorus that a pylorotomy was deemed the operation of choice. This was done by the typical Billroth No. 2 method with a posterior gastrojejunostomy, using chromicized catgut throughout.

Convalescence was uneventful. There was no postoperative vomiting, and no leakage or drainage from the wound.

### EMPHYEMA OF THE THORAX. MAJOR THORACOTOMY AND MOBILIZATION OF THE LUNG

DR. HOWARD LILIENTHAL presented a man, twenty-four years old, who had been admitted to the Fourth Division at Bellevue Hospital on April 18, 1916.

His temperature was 102 degrees. Pulse 120. Respirations 24.

The illness for which he was admitted began about January 10, 1916, with lancinating pain in the left side of the chest, dyspnoea, cough and, later, vomiting. Gradually progressive weakness. No night sweats. Continuous pain.

Physical examination showed flatness over the left chest with absent fremitus. Heart displaced to right.

Urine 1034, no albumin or sugar. Few hyaline casts.

Blood 18,600 leucocytes, 72 per cent. polys., 20 per cent. lymphocytes.

Probatory aspiration yielded thick pus which on culture showed streptococci.

X-ray showed from the back, fluid, from the front, fluid, to the fourth interspace, air above. Well-marked level fluid line.

In nitrous oxide and oxygen anaesthesia administered by Dr. Doran, a long seventh interspace incision was made down to the pleura. The chest was then emptied through a small incision into the thoracic cavity, using the suction machine.

Pleurotomy then continued to the anterior axillary line or a little

## NEW YORK SURGICAL SOCIETY

beyond it. Rib spreader put in, but it was necessary to cut the seventh and sixth ribs at their angles in order to gain sufficient room to work, the left chest being much contracted by the thickened pleura. Lung covered by tough but not very thick membrane. This was incised from above downward and other incisions were made at right angles to the first. The membrane was stripped away but not removed. Lung slightly wounded at several points but good expansion secured. Gauze drainage at the angle of the wound.

### EMPHYEMA OF THORAX

DR. LILIENTHAL presented a man, who had been operated upon for left empyema of the thorax by rib resection in the posterior axillary line, in January, 1916.

There had been continued drainage of large quantities of pus and the patient was in poor general condition.

X-ray showed collapse of lung with large pleural effusion.

Two weeks before, Dr. Lilienthal had operated, making a long intercostal thoracotomy in the seventh interspace and cutting the sixth and seventh ribs posteriorly. The rib-spreading retractor was inserted. The lung had been found covered by a tough thick membrane which obliterated all landmarks. This membrane had been incised from above downward and again in two places across the first line of incision. The lung now expanded nicely and the wound was closed except for gauze drainage at the site of the original thoracotomy. Two days later the gauze had been replaced by a tube put in for the next forty-eight hours and then removed. The patient had done remarkably well and the wound was entirely healed except for a small granulating area not connecting with the thoracic cavity.

The operation which Dr. Lilienthal performed is recommended as a substitute for the more dangerous and crippling thoracoplastic procedures.

### APPENDICITIS WITH DECEPTIVE SYMPTOMS

DR. SETH M. MILLIKEN presented a woman, age twenty-three, who was admitted to the Fourth Surgical Division of Bellevue Hospital, January 29, 1916, with a history of sudden sharp pain in the epigastrium which radiated to the right side, followed by nausea and vomiting. On admission she had a leucocyte count of 20,600, with 80 per cent. poly. There was a slight tenderness at McBurney's point. Her mother did not "approve of operations" and consent was refused. The next day the



## FRACTURE THROUGH THE NECK OF RADIUS

blood-count was 14,200, 74 per cent. poly., with no local symptoms. She remained in the ward one week and was discharged with a diagnosis of appendicitis. She was readmitted on April 26th, with a recurrence of the pain in the right side. Her blood-count was 6500, 59 per cent. poly. There were no abdominal symptoms, except slight tenderness about McBurney's point and slightly above it.

*Operation.*—Iodine preparation. Paramedian incision about three inches long, the cæcum easily exposed and appendix delivered. There were no adhesions. The appendix was very large, acutely distended and injected at the distal end and the tip showed beginning inflammatory necrosis. Fine Pagenstecher hæmostatic purse-string inserted above the base of the appendix, after ligating mesenterium. Appendix amputated with cautery, stump inverted, purse-string closed. This was covered in with a fine catgut figure-of-eight suture. The pelvis was normal to palpation. Wound closed without drainage.

Time of operation, 23 minutes. Gas-ether anæsthesia, 40 minutes.

At the end of the fourth day, patient's condition was perfectly satisfactory, wound clean.

*Second Case.*—Woman, age nineteen. Seven weeks ago had attack with pain, nausea and vomiting, the pain shifting to the right side. She was in bed two days, did not come to the hospital. Present attack began two days before admission, which was April 26th. On admission, her blood-count was 14,000, 79 per cent. poly. There was slight tenderness in the lower right side. No resistance, no mass. Vaginal examination showed intact cribriform hymen. Rectal examination showed uterus small, in normal position, no masses in fornices. Did not appear sick.

*Operation, April 27th.*—Iodine preparation. A three-inch paramedian incision, enlarged upwards and downwards to allow exploratory palpation, which revealed no abdominal abnormality. The cæcum, easily delivered, showed a very long not inflamed appendix with a slight constriction at the very tip making it pointed. The appendix was removed as in the previous case. Wound closed without drainage.

On the fourth day, she had been entirely relieved of her pain and has no symptoms of any sort.

Operation was 40 minutes. Anæsthetic, gas-ether, 48 minutes.

## FRACTURE THROUGH THE NECK OF RADIUS

DR. T. A. SMITH operated upon the following case:

L. G., male, 12 years old, admitted to Bellevue Hospital April 21st. Five days before admission child fell down several steps, striking on



## NEW YORK SURGICAL SOCIETY

the flexed elbow. There was much swelling, discoloration and pain, and after five days of treatment at home for a sprain of the elbow he came to Bellevue Hospital. Examination showed right elbow much swollen, discolored and tender; tenderness most marked over head of radius; no crepitus. Pain on flexion and extension of elbow, and extreme pain when forearm is supinated and pronated.

X-ray shows transverse fracture of neck of radius with forward dislocation of head of bone.

*Operation.*—Vertical incision of posterior aspect of joint directly over head of radius. Joint opened, and upper fragment found displaced forward lying crosswise to the shaft and entirely detached from orbicular ligament.

It was thought best to remove the head of the bone rather than to attempt reposition of the fragments. This was done and the wound closed; the elbow flexed at right angles and held in a sling without splints; passive motion to be begun on the third or fourth day.

---

### To Contributors and Subscribers:

All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 145 Gates Ave., Brooklyn, N. Y.

Remittances for Subscriptions and Advertising and all business communications should be addressed to the

### ANNALS of SURGERY

227-231 S. 6th Street

Philadelphia, Penna.